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ABSTRACT

Activity plans for sixth grade outdoor education experiences comprise the bulk of this curriculum guide. Many of the outlines have been developed through practical application and experimentation by staff members of the Outdoor and Environmental Education Center (OEEC) of the Harrisburg, Pennsylvania, City Schools. Activities and studies for the fall are related to amphibians, insects, poisonous plants, wilderness ecology, simple machinery energy and work, archery, gardening, and observation. Winter activities include the study of fish, invertebrate animals, animal signs, plant differences, human ecology and population, weather reporting and forecasting, compass skills, care and sharpening of tools, and communication. Each plan outlines: (1) steps for classroom introduction of the subject and preparation of the students for their outdoor laboratory exercises, (2) information as provided in the OEEC activity, and (3) topics/projects to consider for classroom follow-up and reinforcement. Vocabulary words, films, and books are listed where appropriate as supplemental aids. This work was prepared under an ESEA Title I contract. Related documents are SE 015 163 for grade four and SE 015 164 for grade five. (BL)

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Harrisburg City Schools

DR. DAVID H. PORTER, Superintendent

ESEA Title I

Outdoor and Environmental Education Center

Sixth Grade: Fall and Winter Curriculum Guide

SE 014 707

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HARRISBURG CITY SCHOOLS

E. S. E. A. - TITLE I

OUTDOOR AND ENVIRONMENTAL EDUCATION CENTER

SIXTH GRADE
FALL
WINTER

CURRICULUM GUIDE

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HARRISBURG CITY SCHOOLS
OUTDOOR AND ENVIRONMENTAL EDUCATION CENTER
210 OAKLEIGH AVENUE
HARRISBURG, PENNSYLVANIA 17111

EDITED BY: JOEL ROBERT JACOBS

Curriculum guide photography by JOEL ROBERT JACOBS

HARRISBURG CITY SCHOOLS 1972

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Director of Outdoor and Environmental Education

We fondly dedicate
this curriculum guide to

MR. GEORGE F. BAUMAN

first director of
the Harrisburg City Schools
Outdoor and Environmental Education Center

FORWARD

This curriculum guide is comprised of activity plans, some of which have evolved from originals written by George F. Bauman in 1966, some of which have been penned by staff members of the O.E.E.C. either jointly or individually and some of which have been authored by myself.

Many of the outlines, developed mostly through practical application and experimentation, have been changed, refined, simplified, enlarged and revised for over six years. It is my hope that all of them will remain in a state of flux.

What we have here is a guide, not a bible. In order to be effective it must remain open to criticism, expansion and future editing.

The following people have contributed their time and skills to the creation of this guide either by researching and writing materials for it, or by teaching from activity plans contained within it, or both: E. Arnold Mahey, Lyvonne LeFlore, G. Henry Osborn, Peter M. Hauer, V. Lee Hartwick, Mrs. Connie (Jones) Miller, Dianne I. Martin, Barry R. Patterson, Mrs. Audrey McGahen, Mrs. Marij Houts, and Mrs. Rose Ann Taylor.

Special thanks go to Mrs. Beverly J. Garland, who typed the original manuscript and to Mrs. Phoebe Ann Wilson whose sketches decorate the titles and the seasonal divider pages.

Funds for the operation of this project are made available though Title I of the Elementary Secondary Education Act. I most gratefully acknowledge the aid of Foster M. Brinser, Harrisburg City Schools' Director of Planning for Federal Projects Administration, in procuring the necessary monies to sustain our program year after year.

I am indebted to Charles A. Rosini, Director of the O.E.E.C., and to Benjamin F. Turner, Deputy Superintendent for Program Planning and Development, for their confidence in me.

Lastly, it is due to the faith and insight of Dr. David H. Porter, Superintendent of Schools, that our Center exists at all.

It is both rewarding and satisfying to work for a school district and an administration that allows a concept like environmental education to become a reality.

J.R.J.
March 1972

HISTORY

Outdoor Education began in the Harrisburg School District as a pilot study with fifth and sixth grade groups from Marshall, Riverside, Steele and Melrose. It was staffed by gym teachers and administrative personnel from the art, music and physical education departments among others.

After a successful pilot program, approval was granted for funding under Title I of the Elementary Secondary Education Act in April of 1966. Eight Harrisburg City Schools (Hamilton, Ben Franklin, Downey, Lincoln, Foose, Cameron and Boas) plus four parochial schools (Our Lady of the Blessed Sacrament, St. Francis, Sacred Heart and St. Patricks) began to participate in a fifth and sixth grade program "to stimulate an awareness of the out-of-doors" in children from the city.

The first director, Mr. George Bauman, influenced the program enormously. He originated the seasonal visitation approach which is still being used, and insisted that small group education in a nature studies program enhanced the rewards for both students and instructors.

The program began as one soundly based in plant study and outdoor nature experiences similar to many summer camps, and developed under the influence of its staff, its directors and hundreds of visiting teachers into todays tripartite of science and environmental studies supplemented with outdoor living activities.

Along with the school-year outdoor science program, the district operated a federally funded summer camp on the grounds of the Center. Fifth and sixth graders identified as having a science need or who were from low income families were eligible for the one week, overnight camping experience.

In the fall of 1969 the second director, Major Lorris E. Brown, turned much of the responsibility for curriculum development over to his staff. The instructors immediately began to enlarge the animal studies program which began under Mr. Bauman as a beg, borrow and bag affair with the Hershey Park Zoo lending some birds and mammals.

Under the present director, Mr. Charles A. Rosini, animal studies have been further expanded, archery and bait casting have been added to the curriculum, the summer camp experience has been opened up to the third and fourth graders in the form of a day camp, and the early childhood grades (K5, 1st and 2nd) and third grade have been included in the school-year program.

School year 1971-72 saw each kindergarten through third grade child in a city school, both public and parochial visiting the O.E.E.C. for two days and each fourth, fifth and sixth grader visiting for four days. At that rate an individual could participate in twenty days of environmental education in his first seven years of school.

Long range goals include a full kindergarten through twelfth grade program, the expansion of career education in environment in the Harrisburg City Schools, workshops to further integrate the outdoor laboratory experience and curriculum into the regular science program in the schools ultimately resulting in every elementary science teacher becoming an environmental specialist, and the development of a central warehouse at the O.E.E.C. for environmental learning aids which could not feasibly be acquired by every school.

The O.E.E.C. exposes children to learning activities which would be impossible to duplicate within the confines of any city elementary school. The necessity of growing up with these experiences in order to become better citizens of Spaceship Earth is its raison d'etre.

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OEEC STAFF

CHARLES A. ROSINI, Director

A 1961 graduate of Pennsylvania State University with a B.S. in Physical Education and Health. He has done graduate work at Syracuse University, P.S.U. and Cortland State and is certified to teach health, physical education, general science and social studies.

He has directed the OEEC since February 1970.

JOEL ROBERT JACOBS,
Curriculum and Staff Development Specialist

A 1965 graduate of Rider College in Trenton, New Jersey with a B.A. in History, he holds his teacher certification from Penn State University in Elementary Education.

He has been with the OEEC since the spring of 1968, and is the editor of the OEECology News, and the Fourth, Fifth and Sixth Grade Curriculum Guides.

MARY D. HOUTS,
Curriculum and Staff Development Specialist

A graduate of Radcliff College, she holds an M.S. in Conservation of Natural Resources from the University of Michigan.

She joined the OEEC staff in September of 1971.

LYVONNE LEFLORE

A 1965 graduate of Jackson State College in Mississippi with a B.S. in Physical Education.

He has been with the OEEC since 1966 except for school year 1968-69 when he was a physical education and health teacher and head basketball coach at John Harris High School.

E. ARNOLD MAHEY

Graduate with a B.S. in Education from Clarion State College in 1956.

He has been with the OEEC since April 1966. He is a past president of the Harrisburg Education Association.

G. HENRY OSBORN

A 1960 graduate of Elizabethtown College with a B.S. in Science.

He has been with the OEEC since the spring of 1968.

PETER M. HAUER

A 1968 graduate of Gettysburg College with a B.S. in Biology, and teacher certification from Shippensburg State College.

He has been with the OEEC since September 1968.

V. LEE HARTWICK

A 1969 graduate of Pennsylvania State University, he has also attended Shippensburg State College and Millersville S. C.

He has been with the OEEC since September of 1970.

BARRY R. PATTERSON

A 1971 graduate of Pennsylvania State University with a Bachelors in Elementary Education.

He has been on the teaching staff here since September 1971.

DIANNE I. MARTIN

After Pre Med. studies at Cambridge University in England, Marteé graduated in 1970 with a B.A. in Biology from Messiah College. She is presently enrolled in a Masters of Education in Biology program at Shippensburg State College.

She has been with the OEEC since the fall of 1970.

AUDREY J. McGAHEN

A 1948 graduate of Allegheny College with a B.S. in Biology with Secondary Education.

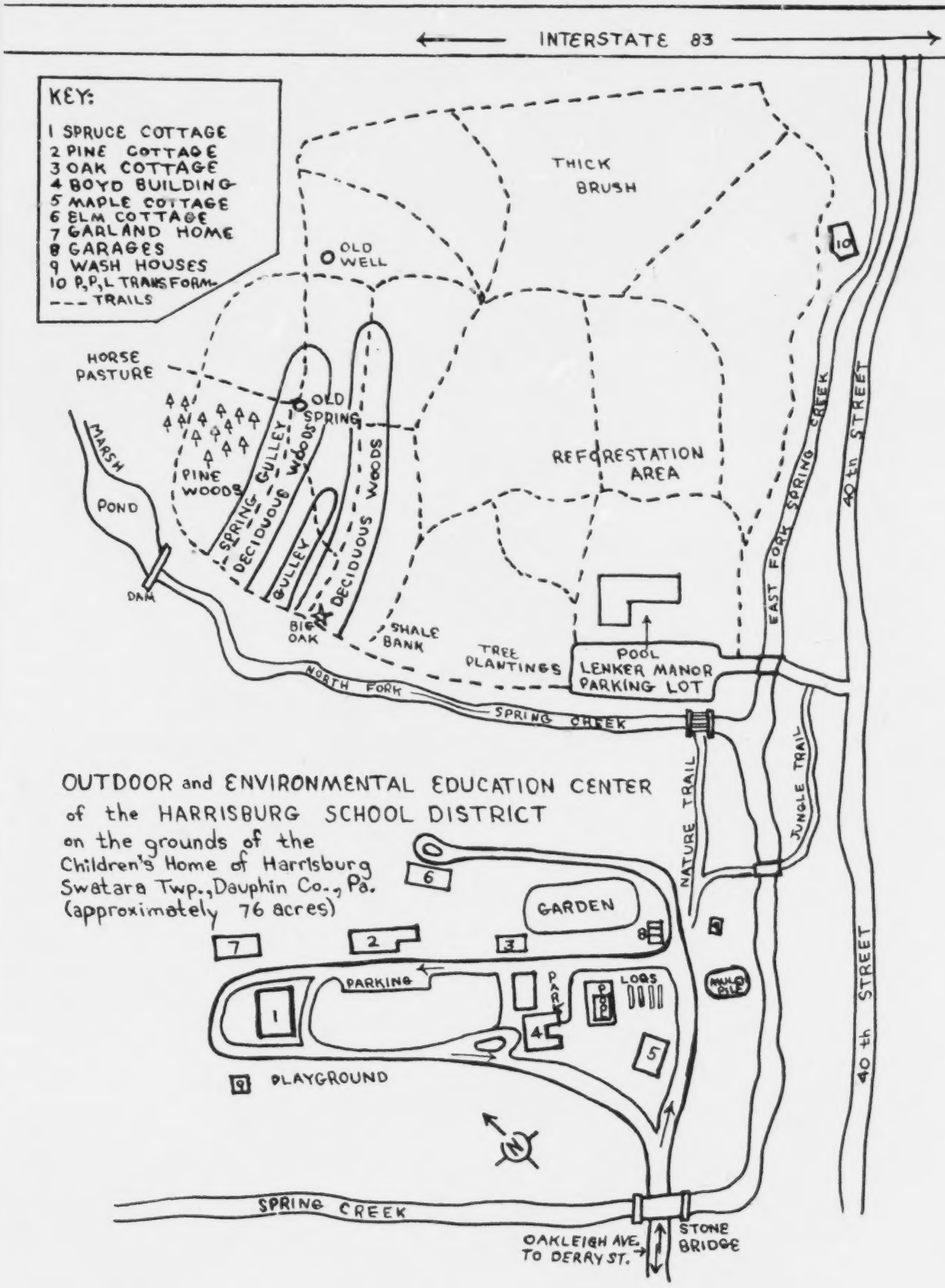
She has been a substitute and part time teacher with the OEEC since 1967.

ROSE ANN TAYLOR, substitute teacher.

SARA K. HINTON, teaching aide.

LATAYNA P. TOTTEN, teaching aide.

BEVERLY J. GARLAND, clerk-typist.


INTERSTATE 83
KEY:
1 SPRUCE COTTAGE
2 PINE COTTAGE
3 OAK COTTAGE
4 BOYD BUILDING
5 MAPLE COTTAGE
6 ELM COTTAGE
7 GARLAND HOME
8 GARAGES
9 WASH HOUSES
10 P,P,L TRANSFORM.
--- TRAILS
THICK BRUSH
OLD WELL
HORSE PASTURE
OLD SPRING
MARSH
POND
PINE WOODS
SPRING GULLEY
DECIDUOUS WOODS
GULLEY
DECIDUOUS WOODS
REFORESTATION AREA
EAST FORK SPRING CREEK
40th STREET
DAM
BIG OAK
SHALE BANK
TREE PLANTINGS
POOL
LENKER MANOR PARKING LOT
NORTH FORK SPRING CREEK
NATURE TRAIL
JUNGLE TRAIL
OUTDOOR and ENVIRONMENTAL EDUCATION CENTER
of the HARRISBURG SCHOOL DISTRICT
on the grounds of the
Children's Home of Harrisburg
Swatara Twp., Dauphin Co., Pa.
(approximately 76 acres)
GARDEN
PARKING
LOGS
MULCH PILE
PLAYGROUND
SPRING CREEK
OAKLEIGH AVE. TO DERRY ST.
STONE BRIDGE

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NOTES TO THE TEACHER

HOW TO USE THIS GUIDE

I. Description of activity plans
   A. The activity plans found in this guide are standardized to a point.
   B. Nearly all of them contain a Classroom Introduction, an O.E.E.C. Activity and a classroom Follow-up.

II. Introductory and follow up activities
   A. The introductory activities are meant to prepare the students for their outdoor laboratory experiences.
   B. The follow-up activities reinforce them.
   C. Preparation and reinforcement are necessary if the students are to achieve a maximum benefit from their activities at the Center.

III. Interchanging suggested activities
   A. Some of the suggested activities, can be interchanged between introduction and follow-up and unless otherwise proscribed the teacher should feel free to do so.

IV. Vocabulary
   A. Vocabulary is listed as an aid to the teacher.
   B. It can be utilized in science or language arts classes or in developing your instructional materials.

V. Films
   A. Films available through the Harrisburg City Schools Film Library should be previewed by the teacher.
   B. Films should always be discussed after the students have seen them.

VI. School neighborhood nature walks
   A. Many activities contain suggested themes for nature walks around the home school neighborhood.
   B. It is possible to combine several of these into one walk.
   C. The more properly directed nature walks the students experience the better.

VII. Adjusting home school science curriculum
   A. Since classroom visits are locked into a tight schedule at the beginning of each year and since

our curriculum is woven around seasonal guidelines some of the science offering in the home school may have to be adjusted to coincide with the OEEC experience.

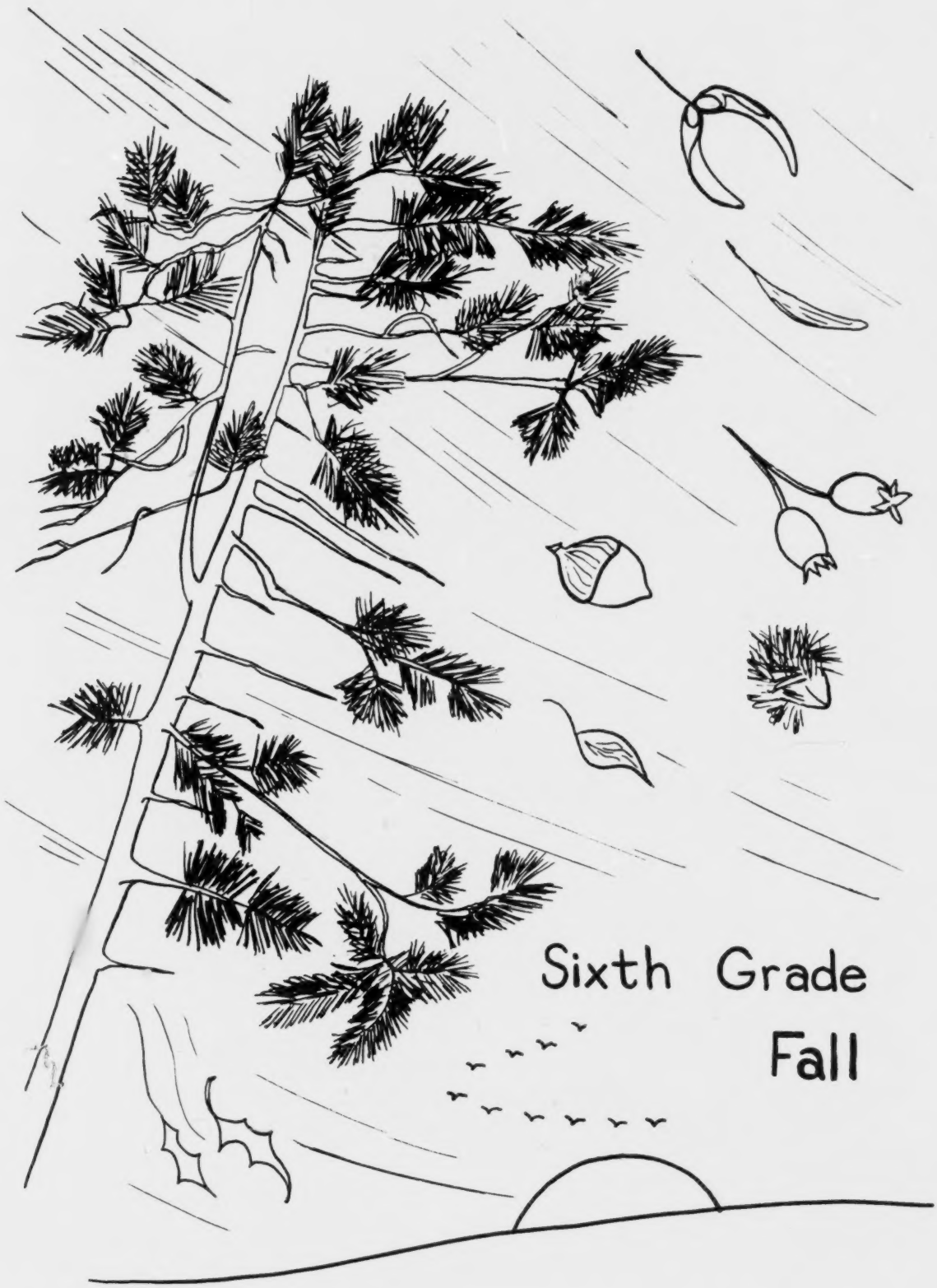
VIII. Interdepartmental coordination
- A. There is a definite need for coordination between the teachers of various subject areas in the home schools so that the children obtain a maximum benefit from their outdoor laboratory experience.
- B. Many activity plans contain suggestions that can be utilized in art, language arts, music and social studies classes.
- C. The specific lack of pencil and paper activities at the OEEC is on purpose.
- D. Language arts work that relates to Center activities should be done in the classroom at school.
- E. Relating concepts discovered at the O.E.E.C. to the urban school-home environment is a necessity whether it be in science or academic classes.

IX. Notebooks
- A. Though no specific instructions will be found referring to notebooks, each child may keep one with all his work concerning the OEEC, or he could have a manilla folder or a large envelope to save his OEEC related school work.
- B. **No** grade should be given on this notebook or collection.
- C. It should <u>not</u> be carried with the students to the Center.

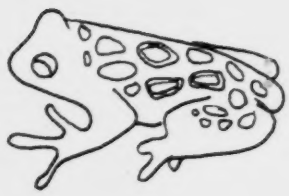
X. Telephone 564-0200 for eco-help
- A. Members of the OEEC staff are available for consultations with all teachers to aid in implementing this guide.
- B. Arrangements can be made for OEEC staff members to come to your classrooms for special teaching visits.
- C. If you think of a neat idea, and need advice or suggestions to complete it, call us.
- D.. The OEEC will lend you any teaching aid, exhibit or specimen that it is not utilizing for instruction at the time you ask.

XI. The blank spaces opposite the printed pages are provided for notes.

to the children . . .


Sixth Grade
Fall

Amphibians



Classroom Introduction

1. Review the five classes of vertebrate animals.

2. Review hibernation of animals. Do amphibians hibernate?

3. Review and discuss the differences between warm and cold-blooded animals. Are amphibians warm or cold-blooded?

4. Vocabulary:

Vertebrate	Salamander	Metamorphosis
Amphibian	Newt	Regeneration
Hibernation	Tadpole	Aquatic

O.E.E.C. Activity

I. The instructor will quickly review the term vertebrate and the distinguishing characteristics of the five classes of vertebrates before emphasizing amphibians.
Note: Frogs, Toads, Tadpoles and Salamanders will be available for the students to see and touch.

II. Characteristics of Amphibians.
- A. Their skin is usually smooth and moist or slippery wet, and never has any special skin covering like hair, feathers, or scales.
- B. Their eggs are laid in water in a gelatinous covering.
- C. Their young are usually water living, taking oxygen from the water by means of gills.
- D. Adults usually develop lungs and take oxygen from the air.
- E. Many can also absorb some oxygen directly through their moist skin.
- F. They are cold-blooded. They acquire the temperature of their surroundings.
- G. Their teeth are not separate and in sockets, but often consist of single uniform rows or ridges, or a few uniform "lumps."
- H. They usually have no claws at the ends of their toes.
- I. The ancestors of amphibians were probably the first vertebrate animals to venture out of water and live on land.

III. Reproduction and Metamorphosis.
  A. The eggs are laid in shallow, quiet water most often in spring time.
    1. Males fertilize the eggs as they are deposited.
    2. The soft eggs are bunched together in an egg mass, or in strings, and are surrounded by a jelly-like layer to protect them.
  B. The eggs of frogs and toads hatch into larva or tadpoles which do not resemble their parents.
    1. Tadpoles and salamander larvae have gills to take oxygen from the water.
    2. They feed on microscopic plants and have mouth and digestive parts adapted to this.
  C. Tadpoles undergo some amazing changes as they mature.
    1. The hind legs start to appear.
    2. The tail gradually disappears as it is absorbed by the rest of the body.
    3. Front legs grow out.
    4. The body shape changes from one that is streamlined to the plumper, broader bodies of frogs and toads.
    5. Gills disappear and lungs develop.
    6. The digestive system is very much altered as it changes from one suited for plants to one suited to digestion of animal food. While this occurs, the tail is absorbed to supply the animal with its needed nutrition.
  D. Adult stage.
    1. Air breathing with lungs.
    2. Predominately feed on insects.
    3. Usually spend much time on land, although most prefer wet areas.
  E. Growth such as this, where there are different stages of development, is known as <u>metamorphosis</u>, which means "change of form."
  F. The word <u>amphibian</u> means "leading a double life," and is appropriate because this type of animal truely is capable of living two lives, one in the water and one on land.

IV. Types of Amphibians.
  A. Frogs.
    1. Have smooth, moist, skin.
    2. They live close to or in water.
    3. Their eyes stick up out of the top of their head. This adaption is for seeing over water while just floating at the surface.
    4. Their front legs are shorter than their rear ones.
    5. The strong hind legs are good for swimming, hopping, jumping, or long leaps.
    6. They have webbed toes on their hind feet for doing the "frog kick" when swimming.
  B. Toads.
    1. Resemble frogs, except they are more plump, broader, and less streamlined.
    2. Their skin is drier and has bumps on it.
    3. They are better adapted to spending more time on land then frogs.
    4. Their hind legs are not as strong as a frogs, so they are

slower and cannot jump as well. They hop rather than leap.

C. Tree Frogs and Peepers.
   1. Smaller than other frogs and toads.
   2. Have sticky pads on their toes.
   3. Can easily climb up trees and leaves, or even the glass of a window.
   4. Their loud, clear, peeping call is a sign of spring.

D. Tadpoles, as already illustrated, are not really a separate group, but are the immature, or larval stage of frogs and toads.

E. Salamanders.
   1. Have tails, legs, and smooth, moist skin.
   2. Some are strictly aquatic, but all live in moist or wet places.
   3. The following list compares and contrasts lizards and salamanders, which are alike only in their basic body shapes.

a. Salamanders	b. Lizards
(1) an amphibian.	(1) a reptile.
(2) smooth moist skin.	(2) dry skin covered with scales.
(3) toes are clawless.	(3) toes bear claws.
(4) never have more than four toes on the front feet.	(4) usually have five toes on front limbs.
(5) lay eggs in water.	(5) lay eggs on land.
(6) live in water or wet places, when on land. Many are nocturnal, and all avoid direct exposure to the sun.	(6) most like to sun themselves.

F. Newts.
   1. Various small salamanders which spend much or all of their lives in water.
   2. The term is sometimes used to refer to the younger, larval, aquatic stage of a salamander's development, just as a tadpole is an immature frog or toad.
   3. Other references consider newts to be just certain species of salamanders.

V. Value of Amphibians.
   A. They help to maintain the balance of nature by eating great numbers of insects, and therefore are friends to humans.
      1. Besides insects, adults also eat worms and slugs.
      2. Feeding habits of frogs and toads.
         a. Will sit very still and wait patiently for a long time.
         b. Tongues are attached at the front of the mouth, are elastic (stretchy), and sticky.
         c. When an insect gets close enough, the tongue is flipped out and around it, and quickly returned to the mouth.
   B. Amphibians also serve as a part of nature's food chain by being food for other animals. They are eaten by fish, snakes, birds, raccoons, and others.
   C. Some people consider frog legs a delicacy.
   D. Frog calls add much to the aesthetic values people sense in nature.

E. Frogs are often used in laboratory experiments by scientists.

VI. Survival.
A. Females usually lay large numbers of eggs.
B. Many have good protective coloration.
1. Frogs, for example, are light on the bottom (fish look up toward light surfaces), and dark on top (other animals usually look down).
2. Toads blend in extremely well with dried grasses and leaves.
C. Some tree frogs can change their skin color to match their surroundings, turning green on leaves and brown on bark.
D. Frogs can take long jumps on land, and swim well in water.
E. Smooth, wet skins make them slippery and hard to hold.
F. Toads sometimes play dead.
G. Toads sometimes inflate their bodies.
H. Toads sometimes urinate on their captors.
I. A toads skin can secrete a whiteish fluid which is distasteful or even very poisonous when in contact with eyes or mouth.
J. If something tries to grab a salamander by the tail or a leg, it breaks off; a new one will be regenerated.
K. Salamanders, and frogs and toads to a lesser extent, are excellent hiders, crawling under logs and rocks, and into small cracks.
L. Many amphibians bury themselves down into the mud at the bottom of ponds and streams to escape their enemies.
M. In northern areas they hibernate in the mud or deep in cracks over the winter months.

VII. Sounds and Calls.
A. The familiar songs are made by the male frogs and toads.
B. It is a mating call to attract the females.
C. The sound is amplified by puffing out a vocal sac in their throats.

VIII. "Tall Tales" about Amphibians.
A. "Toads give people warts." - No! A toad's urine or skin secretions may be irritating to our skin, but will not give us warts.
B. "When a tadpole gets legs, his tail falls off." - No! As legs develop both the tail and gills are gradually absorbed by the rest of the body.
C. "Sometimes it rains toads." - No, but often large numbers of baby toads travel from place to place during or after a rain.

IX. Conservation of Amphibians.
A. As friends to humans, and more importantly as a part of nature's pattern, amphibians should be protected.
1. They are important in nature's balance and food chains.
B. There are few laws protecting amphibians, although some states do control the collecting and harvesting of frogs.
C. What can we do?
1. Don't collect specimens, unless you can really care for them.
2. Don't kill any amphibians.
3. Don't destroy their homes or natural habitats.

X. The instructors will show the students how we care for our amphibians, and answer any question they may have concerning them.

XI. The students will be given an opportunity to search for amphibians during their observation hike, however, all specimens will be left as they were, when the group is finished discussing them.

Classroom Follow-up

1. Review the life cycle of amphibians.

2. Discuss the types of amphibians which are common to Pennsylvania. A booklet which would be helpful is "Pennsylvania Reptiles and Amphibians," which may be obtained by writing to the Pennsylvania Game Commission, 3534 Walnut Street, Harrisburg, Pennsylvania.

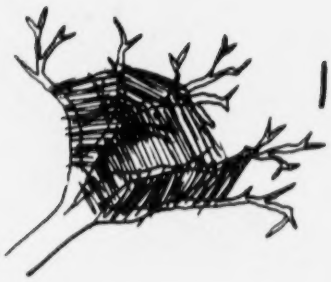
3. Another interesting reference is the Golden Nature Guide "Reptiles and Amphibians," by Zim and Smith, Golden Press, New York.

4. If you have an aquarium in your classroom, buy a few newts for it and observe them.

5. If you have a terrarium with some plants, add a water bowl and one or two salamanders, frogs, or toads. By also raising meal-worms it is simple and very interesting to feed them.

6. Films from the Harrisburg City Schools film library relating to this topic are.

   "Amphibians- Frogs, Toads, and Salamanders," #1004
   "The Terrarium- Classroom Science," #282



INSECTS:

FRIENDS or ENEMIES?

Classroom Introduction

I. Review the characteristics of insects with the class
   A. Body Characteristics
      1. no backbone
      2. hard shell
      3. three body parts, head, thorax and abdomen
      4. three pairs of legs on the thorax
      5. one pair of antennae
      6. usually one or two pairs of wings as adults
      7. respire through a series of tubes running throughout the body which are connected to tiny holes in the exoskeleton
   B. Growth and reproduction - three types
      1. direct development (no metamorphosis)
         a. eggs hatch into miniatures of adult
         b. nymph molts and grows larger
         c. adult wingless
         Example: silverfish
      2. gradual development (incomplete metamorphosis)
         a. egg hatches into nymph
         b. nymph molts as wings develop
         c. adult has full wings
         Example: grasshopper
      3. complex development (complete metamorphosis)
         a. egg hatches into larva (a worm-like creature)
         b. larva grows and molts
         c. goes into pupal, or resting stage, inside a plant, underground, or in a special case
         d. adults emerge from pupal stage with wings and ability to reproduce
         Examples: honeybees; butterflies
   C. Habitat
      1. insects live in all habitats except the sea

II. Vocabulary:

Thorax	Metamorphosis	Predator	Fungus
Abdomen	Pupal	Pollination	Virus
Antennae	Parasite	Larva	Pesticide
Nymph	Respiration	Insecticide	Beneficial
Bacteria	Biological control	Chemical control	Grub

O.E.E.C. Activity

I. Numbers

A. There are more different kinds of insects than all other living animals in the world put together. Over 675,00 have been described and new ones are being discovered all the time.

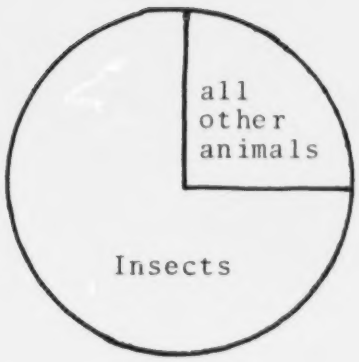


Diagram represents relative abundance of insects to all other animals.

B. They are plentiful in numbers of individuals as well as numbers of different kinds.
   1. insects can produce large numbers of young - a queen honeybee can lay 4,000 eggs a day
   2. it is estimated that there may be from 1 million to 65 million insects per acre in some soil

C. Ecological importance
   1. a vital part of fresh water and land chains, they are eaten by many types of fish, birds, amphibians and mammals, and they inturn feed on almost every living thing

II. Relationship to man

A. Insects are both harmful and beneficial to man
   1. it is estimated that insects cause about three and one-half billion dollars worth of damage a year in the United States alone
   2. it is also estimated that pollination of plants by insects is worth about four and one-half billion dollars a year in the United States

B. Harmful insects - insects attack man himself, and just about anything that he grows manufactures or uses
   1. attack upon plants
      a. insects cause a large amount of destruction in food crops, in orchards and in forests
      Examples: locusts, grasshoppers, scale insects, coddling moths, spruce bud-worm, gypsy moth, aphids, weevils
      b. some carry fungus or virus disease to plants
      Example: Dutch elm, bark beetle
   2. diseases and irritants of man and animals
      a. they carry many diseases, bacterial, virus and other, especially in the tropics
      Examples: certain fleas- bubonic plague; tapeworms

certain flies- typhoid and polio
certain mosquitoes- malaria (a protozoan), yellow fever, sleeping sickness

b. stinging or irritating
Examples: honeybee, yellow jackets, ants, bed-bugs, back swimmers, certain flies, lice

3. damage to stored food and other goods
   a. they destroy more than 300 million bushels of grain in this country every year
   b. insects destroy woolen material, wood, furniture and stored food other than grain. There is one insect which can even bore through lead cables

C. Beneficial insects
   1. pollination of most orchard trees, many vegetables, and field crops such as clover is done mostly by bees and flies.
   2. produce products which are commercially valuable
      Examples: honey, beeswax, silk and shellac
   3. important in keeping harmful insects under control by parasitism and predation
      Examples: ladybugs eat scale insects and aphids; members of the bee and wasp family parasitize many other insects by laying eggs in their larvae
   4. scavenger insects feed upon dead plants and animals, hastening the process of decay
   5. some insects are used by scientists to study aspects of heredity, evolution, stream pollution and others
   6. many beautiful and fascinating insects have provided inspiration for astists, writers and musicians
   7. in some parts of the world insects are eaten as larvae, adults, or both

III. Insect control
   A. Chemical control (insecticides or pesticides have some disadvantages)
      1. some are very poisonous to man, to fish, to amphibians, and to all other animals
      2. some build up in the bodies of other animals over a period of time until they cause problems like the inability to reproduce
      3. most kill the beneficial insects which prey on the harmful ones
      4. insects sometimes become resistant to the chemicals, which requires stronger doses, or negates their use
      5. sprays or dusts can be carried by wind or water to where they are not needed, or wanted
   B. Biological control
      1. since there are many insects which prey on others, it is often useful to try to breed these and release them in large numbers. Since many predators will only prey on certain species this can be a safe direct

way of destroying insect pests. The most successful example of this is the use of lady-bugs to control scale insects in orange groves.

2. certain bacteria and viruses which attack only specific insects may be released. The Japanese beetle was brought under control by spreading milky disease which kills the grubs.

C. Other methods

1. flies and mosquitoes can be controlled to a certain extent by destroying their habitats. Keeping food, garbage and sewage covered to combat flies, destroying areas with standing water to keep mosquito larvae from hatching.
2. the screw-fly, in the southern United States, has been controlled by sterilizing males by irradiation and thus eliminating successful reproduction.

Classroom Follow-up

1. Have the class pick an insect pest for an in-depth study.
2. Discuss fly control in the city.
3. Request enough copies for all your students of the pamphlet "What Is Fly Control?" from the Pennsylvania Department of Health, Division of Sanitation, Harrisburg, Pennsylvania.
4. Have your students draw charts or pictures of the three types of insect life cycles.
5. Study the honeybee, especially its role in pollination, and the production of honey and beeswax.
6. Have your students pick one human ailment affiliated with an insect and study its effects on people and the methods used in controlling it.
7. Do research on the silk worm.
8. Study about the production of shellac.
9. Do research on DDT.
10. Draw charts or pictures showing the relationship of DDT spraying to the decline in population of ospreys, bald eagles, brown pelicans and other fish-eating birds.

11. Write to the Environmental Protection Agency, Washington, D.C. for information on the chemical and biological control of insect pests.

12. Films from the Harrisburg City Schools film library that may relate to this lesson are:

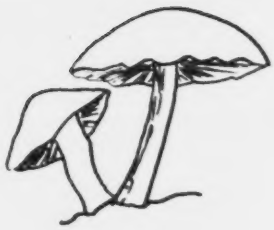
"The Winners"

"Insects That Help Us"

"Insect Enemies And Their Control"

"The Water Spider- A Study In Adaption"

POISONOUS PLANTS



O.E.E.C. Activity

Objective:

To show the students how to recognize some of the poisonous plants they may come in contact with here at the Center or on a hike in the Central Pennsylvania area. This will be an inside-outside activity. Inside, there will be specimens of poisonous plants for the students to examine. Outside, the students will search for poisonous plants in their natural habitat.

I. There are many plants which may be harmful to man and animals. Three important ones are:
   A. Poison Ivy or Oak
      (the vine type is the one we ordinarily call ivy)
      (the upright bush of the same family we call oak)
      1. Leaves- "Leaflets three, let it be."
         a. The leaves of both are shiny green.
         b. Each leaf is made up of leaflets notched at the edges.
         c. Two of the leaflets form a pair on opposite sides of the stalk and the third stands on the tip of the leaf.
         d. In the fall these leaves turn red or orange in color.
      2. Flowers
         a. When in bloom, small bunches of greenish flowers are attached to the main stem close to where the leaf joins the stem.
      3. Berries
         a. The flowers turn into clusters of poisonous berries.
         b. The berries are yellowish-white and very waxy.
      4. Oil from these plants causes severe itching and eruptions on the skin.
      5. Ecological role
         a. Fruits are eaten by over 60 species of birds including the bobwhite, pheasant and ruffed grouse.
         b. Seeds may be distributed by passing undamaged through the birds' digestive system.

B. Poison Sumac
(a shrub or small tree, largely confined to swamps, which may reach a height of 20 feet)
1. Leaves
   a. Large compound leaves measuring 6 to 12 inches.
   b. 7-13 pointed leaflets.
   c. Leaflets are smooth not notched or toothed.
   d. Leaves are velvety, dark green on the top side and pale green on the under side.
   e. May turn yellow or red in autumn.
2. Hairless buds and twigs.
3. Flowers appear from May to July.
4. Berries
   a. Drooping white clusters aid in identification.
   b. Harmless sumacs have red berries which form dense, erect clusters.
   c. May remain from August to the following spring.
5. Skin irritant causes symptoms similar to poison ivy.
6. Ecological role
   a. Fruits are eaten by many birds.
   b. Twigs are browsed by cottontail rabbit.

C. Fungi
(simple plants which lack chlorophyl and so cannot make their own food)
1. There are about 250,000 kinds of fungi.
2. Not all are poisonous.
3. Mushrooms
   a. To some people mushrooms that are poisonous are are called toadstools.
   b. At the OEEC we will treat them all as poisonous mushrooms and not experiment with any.
   c. Many authorities disagree on the toxicity of some mushrooms.
   d. Many reference books are confusing in their descriptions of poisonous and non-poisonous mushrooms.
   e. Many times, diagrams or photographs are not clear enough for accurate field identification.
   f. Unless you are with an expert you should not eat any mushrooms unless they come out of a can or bottle, or have been purchased from a reputable food market.
4. Ecological role
   a. Aid greatly in the decay process

II. Other poisonous plants found at the OEEC:
Cherry tree-
twigs, leaves and seeds (heat aids in the development of cyanide - never use branches to roast hotdogs, etc.)
Oaks-
foliage and acorns may cause damage to kidneys. Not fatal.
Elderberry-
leaves and sap are poisonous. Berries are good cooked but must be quite ripe to eat raw.

Nightshades-
all parts are poisonous especially the unripe berry. Fatal.
Daffodil, Narcissus, and Hyacinth-
bulbs are poisonous. Possibly fatal.
Crocus and Star of Bechlehem-
bulbs cause vomiting and nervous excitement.
Lily of the Valley-
leaves and flowers cause irregular heartbeat, digestive upset and mental confusion.
Buckeye-
seed is poisonous. Can be fatal.
Pokeweed-
root is poisonous. Not often fatal.
Wild garlic, Bracken fern, Horsetail-
sometimes poison cattle.

III. Seven basic rules:

1. Know the plants you come in contact with or plan to eat.
2. Gather all wild food with great care.
3. Wash all vegetables thoroughly.
4. Teach children not to handle plants that are unfamiliar to them.
5. Avoid eating any domestic or wild plants growing near a heavily traveled highway because of the poisonous lead from exhaust fumes.
6. Follow recipes or directions carefully and cook only those parts specifically recommended by reliable authorities.
7. Call a doctor, if any poison symptom occurs.

"THE BEST WAY TO AVOID POISONOUS PLANTS IS TO STAY IN BED."

Classroom Follow-up

1. Review the seven basic rules listed in part III. of the OEEC Activity.

2. Review identification of Poison Ivy, Oak and Sumac.

3. Research the life cycle of a mushroom.

4. Pennsylvania and Ohio are leading states in the production of edible mushrooms. Study about mushroom farming.

5. Many mushrooms are good to eat. Discuss recipes which include mushrooms. Have each student make a list of their favorite ways to eat mushrooms. Example: on pizza, in gravy, in stews, in soup, with vegetables.

6. A film from the Harrisburg City Schools film library which may help with this lesson is:

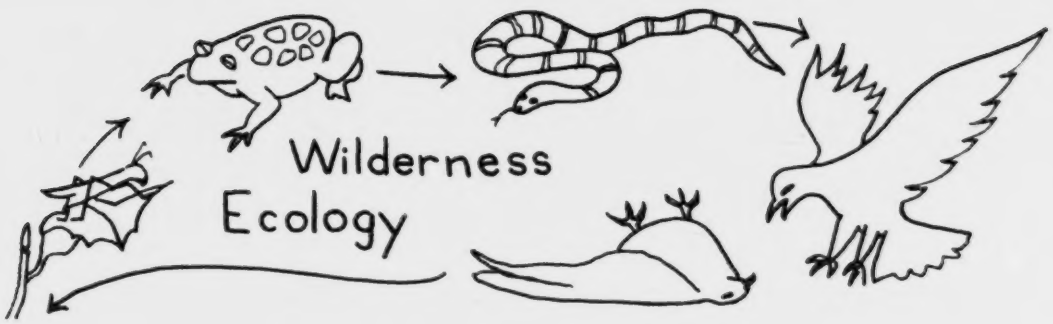
   "Plants That Have No Flowers Or Seeds," #1161.

7. Vocabulary:

Sumac	Fungus	Irritant
Ivy	Mushroom	Poison
Compound leaf	Toadstool	Symptom

8. Bibliography:

"A Field Guide to Trees and Shrubs," by George A. Petrides, illustrations by George A. Petrides and Roger Tory Peterson, Houghton Mifflin Company, Boston.



Classroom Introduction

1. Review the process of photosynthesis.
2. Discuss the word "ecology."
3. Find out how many students have seen a bear, wolf or mountain lion "in the wild" near Harrisburg. Advise your students that these animals used to live in this area. Discuss why they don't live here anymore.
4. Study the early exploration of this area.
5. Do research on the Susquehannock Indians.
   a. what did they eat?
   b. what did they use for clothing?
   c. where did they live?
6. Vocabulary:

Photosynthesis	Primeval	Cycle
Carbon dioxide (CO_2)	Habitat	Web
Oxygen (O_2)	Ecology	Predator
Nitrogen (N)	Canopy	Carrying capacity
Respiration	Herb	Scavenger
Inorganic	Shrub	Carrion
Omnivore	Decomposer	

O.E.E.C. Activity

I. The Primeval Forest

At one time Harrisburg and most of Pennsylvania was covered with a vast virgin forest. Mountain lions ranged freely, herds of elk fed along the river meadows, huge flocks of passenger pigeons darkened the sky at times and thousands of grey squirrels fed on nuts from the forest trees.

In 1608, when Captain John Smith sailed along the lower Susquehanna River and met the Susquehannock Indians, they were dressed in the skins of bears and wolves which were plentiful.

The main part of the forest was very different from the woodlands which we know today. The trees were huge and the tops were so thick that little sun came through to the ground. This meant that very little vegetation grew on the forest floor, and in the words of one explorer "one can walk...with much pleasure and see an enemy from considerable distance."

II. Forests Layers

The indians did not make their encampments in the interior of the forest. They lived in open places along rivers and lakes, for the edge of the forest had much more abundant plant and animal life.

Here, where there were not so many large trees, more sunlight could reach the ground. Songbirds lived in these areas and white-tailed deer, rabbits and other small game were to be found. Shrubs and young trees reached up to the sunlight and the earth was covered with plants.

The forest in these more open areas may be looked on as a series of layers:

A. The canopy - crowns of the tallest trees, forming a kind of tent over the rest of the forest.
   1. most of the food for the rest of the forest is manufactured in the leaves of the canopy through the process of photosynthesis.
   2. the top of the canopy is not a good habitat for animals
      a. the light is blinding
      b. it is hot (sometimes 20 degrees hotter than the forest floor)
      c. it sways violently in storms
   3. under the very top many insects and some birds such as the scarlet tanager and certain warblers spend a great deal of time.

B. The <u>understory</u> - young trees growing up to the canopy and smaller trees such as dogwood
   1. home of many birds (woodpeckers), insects and mammals (squirrels and wood mice).
   2. vines such as poison ivy and virginia creeper twine around trees up to this layer.

C. The <u>shrub layer</u> - small trees and woody plants with many stems (rarely above 6 feet)
   1. gives protection to many mammals, birds, reptiles and insects.
   2. provides food for the above.

D. The herb layer - plants with soft, non-woody stems
   1. wildflowers bloom here in the spring before the canopy closes over.
   2. the rest of the year this layer grows in the beams of light coming from openings in the canopy.
   3. mice, insects, snakes, wood turtles, toads and certain birds live here.

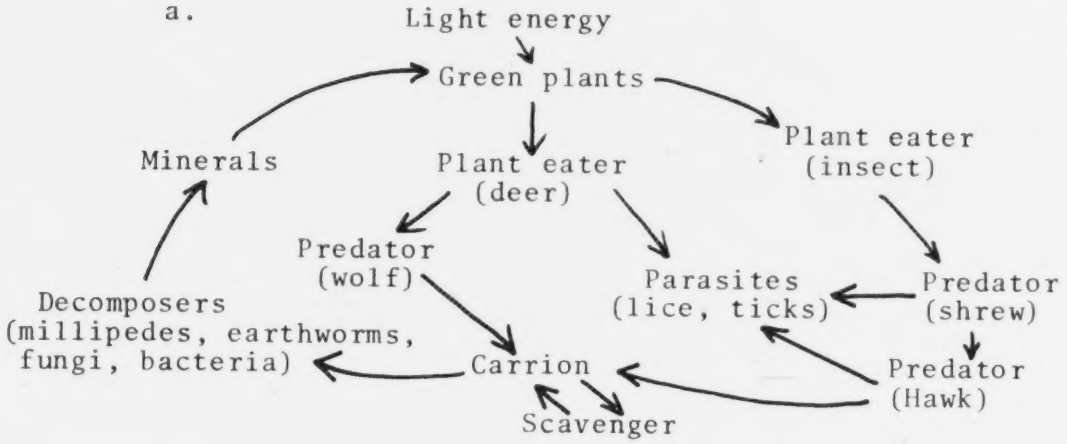
E. The forest floor - the wastebasket for all above it
   1. each acre can receive over a ton of plant and animal waste per year.
   2. the dead material is teeming with tiny visible and microscopic animals, fungi and bacteria.
      a. over 1,000 animals, mostly insects and small mites, can be found in one, 1 inch deep, square foot of forest soil.
      b. in one pound of forest litter there may be as many as 30 billion bacteria working night and day, breaking down dead materials.
   3. in this climate it takes 3 to 4 years for leaves to completely decay, but to get an inch of top soil built up can take from 300 to 1,000 years.
   4. the forest soil is full of holes made by earthworms and other burrowing animals. It has dead plant and animal matter worked into it. For these reasons the forest floor has a good capacity for holding water, and acts like a great sponge which slowly releases water into underground streams.

III. Cycles and Webs - Forest Ecology

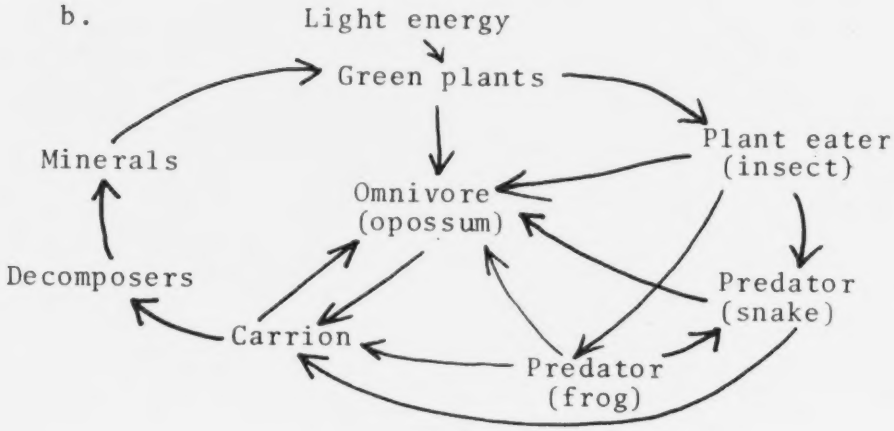
A. The study of the relationship of living things to each other and to their non-living surroundings is known as ecology. Two of the important types of relationships are cycles of waste materials, and food webs.
   1. two examples of cycles of waste materials:
      a. oxygen given off as a waste material in the process of photosynthesis is used by animals for respiration. The carbon dioxide given off by animals as a by-product of respiration, is used by plants in photo-synthesis.
      b. nitrogen, an important part of living tissue, is absorbed by plants from the soil. Animals then eat the plants. When the animals die, the nitrogen in their bodies is released back into the soil by agents of decay. There it becomes available to plants once again.

2. two examples of food webs:

a.



b.



c. food webs like these went on undisturbed in the wilderness for thousands of years. Each area could support a certain number of each living thing (plants, plant eaters, and predators), this is known as the carrying capacity of the area. When the white man came to this country, he changed the wilderness habitat by killing large numbers of animals, cutting down many trees and re-planting the area with his own types of plants.

Classroom Follow-up

1. Obtain a copy of the endangered species list from the Environmental Protection Agency, Washington, D.C. Discuss how the food webs of these animals have been damaged.

2. Discuss the qualities which make some animals like the opossum and the fox much more able to adapt to a man made environment than animals like the wolf, lynx, moose and grizzly bear.

3. Discuss the importance of predators in the wilderness food chain.

4. List the animals common to the central Pennsylvania area. Discuss who they eat, and who eats them.

5. Subscribe to National Wildlife magazine, International Wildlife magazine, and Ranger Ricks magazine for your classroom. The address is: National Wildlife Membership Services, 1412 16th Street, N.W., Washington, D.C. 20036.

6. Bibliography:

"The Forest and the Sea," by Marston Bates, Random House, New York, 1960.

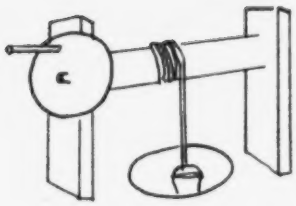
"Mammals of Pennsylvania," by Kenneth J. Doutt, Caroline Heppenstall, and John E. Guilday, Pennsylvania Game Commission, Harrisburg, 1967.

"The Life of the Forest," by Jack McCormick, McGraw Hill, 1966.

"Fundamentals of Ecology," by Eugene P. Odum and Howard T. Odum, W. B. Saunders Company, Philadelphia, 1969.

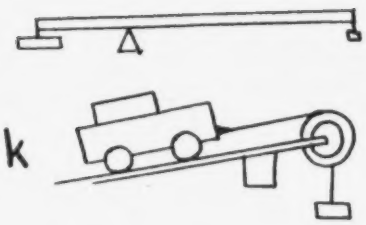
7. Films from the Harrisburg City Schools film library that may relate to Wilderness Ecology are:

"Sunlight- A First Film"
"Air Pollution- A First Film"
"Water Pollution- A First Film"
"Altered Environments: An Inquiry Into The American Highway"
"Altered Environments: An Inquiry Into The American Wildlands"
"Man's Effect On The Environment"
"Urban Ecology: Garbage Disposal"



SIMPLE MACHINES

Energy & Work



Classroom Introduction

Some important concepts about energy and its sources.

I. Energy is the ability to do work.

II. Energy is required to move anything.

III. All people and animals get energy from food.

IV. The energy man uses to do work comes from various sources such as fuels (wood, coal, gas and petroleum products), the wind, flowing water, or the atom.
Electricity is made by using one of the above listed sources.

V. All energy, except atomic energy, comes from the sun either directly or indirectly.
   A. Directly- by heating air and evaporating water which causes wind to blow and clouds to form producing rain and water flowing back to the seas.
   B. Indirectly- sunlight may be used and the sun's energy captured and transformed in green plants, into plant sugars (glucose). These become the basis for all food.
      1. Food stored in various parts of plants (seeds, roots, leaves, fruits, and stems) is used directly by animals and people for energy (calories) and other nutrients (proteins, minerals, etc.).
      2. Many animals eat other animals for food but further back in the food chain, all food was first produced by plants which obtained it from sunlight.
      3. Wood has the sun's energy stored in it (cellulose) which is released by burning.
      4. Coal was made from plants millions of years ago and still contains the sun's energy that was in the plants. Gas and petroleum also were once plant and animal matter which got their energy from sunshine hundreds of millions of years ago.

VI. Atomic energy comes from within the atoms of certain matter like uranium and hydrogen. This is not some strange and different form of energy. It is like the sun's energy because the sun itself is a mass of continuous hydrogen atomic explosions occurring constantly, supplying us with most of our energy from 93,000,000 miles away.

VII. We are fortunate to be at the optimum distance from the sun, so as not to be too hot or too cold for life as we know it.

O.E.E.C. Activity
(2 activity periods)

OBJECTIVE:

This activity is an inside-outside study of the six simple machines. It will begin with a quick explanation of energy and work, and finish with demonstrations which could not be performed in a classroom.

INTRODUCTION:

After many thousands of years, man learned to save his energy by making use of some kind of tool or machine to do his work.

Man first used his own muscles to do his work. This was limited according to his strength. His body was his machine.

Long ago man found that he could climb a gradual slope easier than a steep hill. So he built an inclined path to get to his cave in the cliff rather than climb the steep sides. Thus he learned to lift himself by his own energy in an easier manner.

Man also knew that he could move objects other than himself to where he wanted them. By using tools man found he could make his moving easier.

Modern man has continued to use and improve upon the basic tools of early man. There are six tools that evolved through use which today we call the six simple machines.

1. INCLINED PLANE

A short incline makes it hard to move an object up a hill. The longer the incline the smaller the amount of energy needed.

Men use inclined planes to put barrels on trucks, and to take them off. It is easier and requires less energy to roll the barrel up the inclined plane than to pick the barrel up and put it on the truck. Using an inclined plane this way, one man can do the work of two or three men.

Outside we will roll a log up a hill to show that it is easier to move it up the inclined plane than to pick it up and carry it to the top of the hill. The sliding board on our playground is an inclined plane.

2. WEDGE

A tool in the form of an inclined plane used to pry things apart; to split logs.

A long thin wedge is easier to use than a short, fat one.

Outside we will split logs with a long, thin wedge and a short, fat wedge.

3. SCREW

A screw has threads that make an incline along a piece of metal.

The instructor will pass out screws and nuts and bolts. The students will be able to feel the incline of a screw by turning it between their finger tips. They will also be able to notice that we can draw a nut up and down a bolt by turning it along the threads (actually only one thread or incline).

Outside we will use a screw jack to lift a heavy weight.

4. LEVER

A lever concentrates the energy to be used at one spot. Circus clowns use levers to propell their comrades into the air. Ancient warriors used catapults to hurl projectiles at their enemies.

The instructor can rocket a paper ball by using a ruler lever and a pencil fulcrum.

Outside we will lift a heavy object like a log with a lever. The see-saws on our playground are levers.

5. WHEEL

To move a heavy object along the ground for a distance is hard work and calls for great amounts of energy. The friction of the object against the ground is the problem.

Early man found that a sled was useful in reducing friction. Later, he put rollers under the sled, which made moving it much easier. Finally, he added disks to the rollers, lifting them off the ground, and reducing friction even more. The disks became wheels, and the rollers became axles.

Outside we will roll a heavy object on rollers. The merry-go-round on our playground is a wheel and axle.

6. PULLEY

A pulley is a wheel with edges that is used with a rope. While the wheel reduces friction its edges keep the rope from slipping off.

Outside we will lift a heavy log, first with no pulley, then with a single pulley and finally with a block and tackle with four (4) pulley wheels.

Classroom Follow-up

1. Make up a bulletin board of pictures the students find and collect showing how man puts simple machines to work for him.

2. Have the students study and demonstrate the six simple machines using "The Young Scientist, His Problems and Methods," as a guide. Perform the experiments it illustrates in Unit 8.

3. Vocabulary:

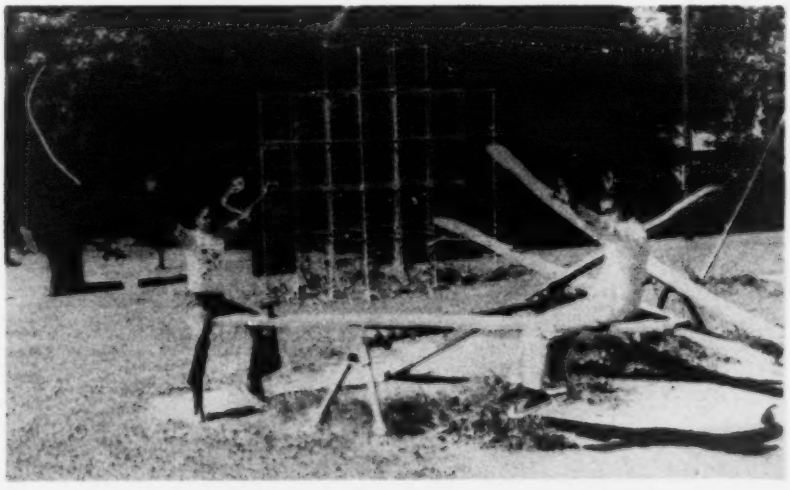
Energy	Pulley	Plane	Screw	Fulcrum
Work	Incline	Wedge	Wheel	Lever

4. If there is some kind of construction going on near your school, take your students to observe it. Discuss how the laborers use the six simple machines to aid them in their work.

5. Bring in a toolbox. Discuss how modern tools are built on the basic principles of the six machines (as tools). You may borrow some tools from your custodian.

6. Films from the Harrisburg City Schools film library that relate to this lesson are:

   "How Simple Machines Make Work Easier," #1111
   "How Wheels Help Us," #1112



Classroom Introduction

1. Advise your students that they will be shooting during this visit to the OEEC and suggest that they wear, if possible, a knit shirt, fairly close fitting blouse, T-shirt, or tight fitting top of some kind, preferably with short sleeves. Students should also bring a light jacket for hiking, if they wear a short sleeved shirt.

2. Discussion Points:
   a. Describe the development of the bow and arrow from the pointed stick of early man to the crossbow of the Middle Ages.
   b. See if your class can establish a coorelation between the bow and arrow and the guided missles of modern warfare.
   c. What are the advantages of bows and arrows over spears?
   d. What are the advantages of guns over bows and arrows? (The American West)
   e. What are the advantages of being able to kill for food or defense over great distances?
   f. Research the historical importance of the longbow.

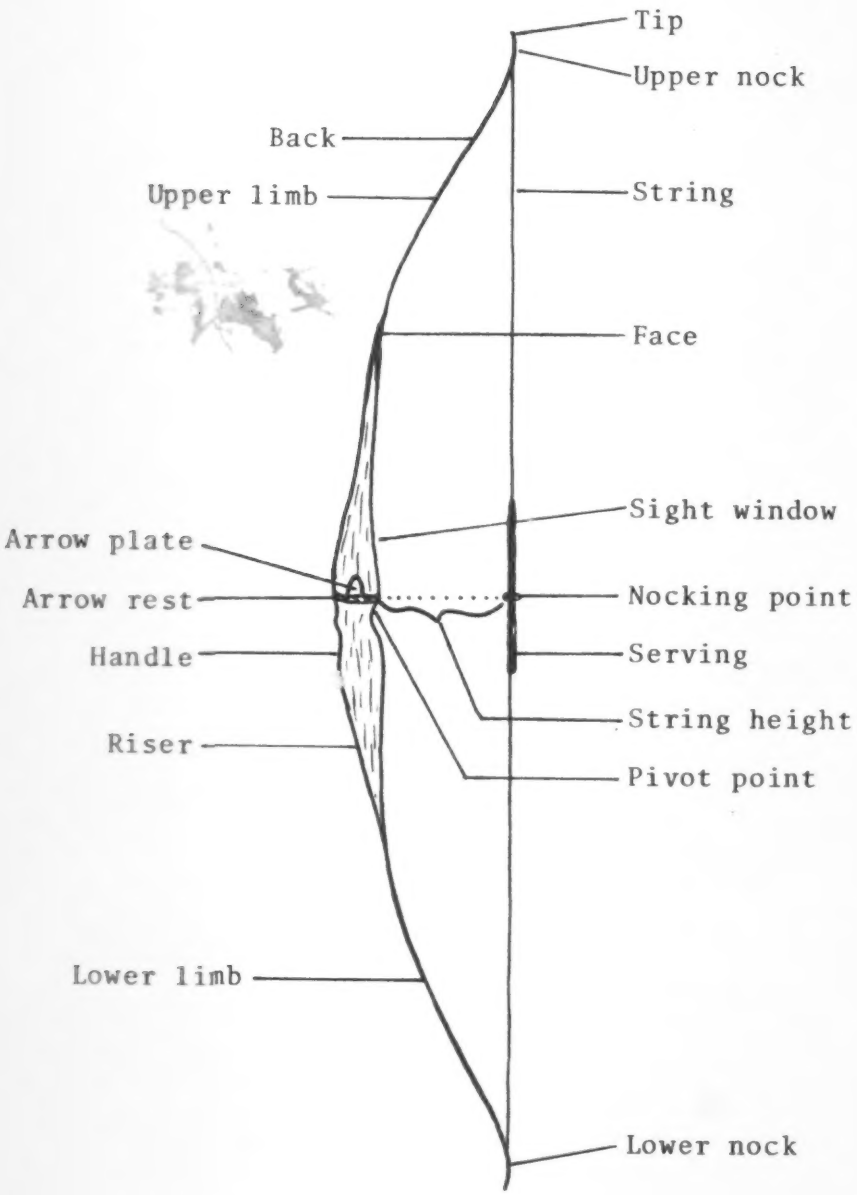
3. Suggest to your class that they read books, stories or poems in which the bow and arrow played an important role. Some which may be in your school library are:
   Robin Hood
   Ivanhoe
   The Song of Hiawatha
   The Last of the Mohicans
   William Tell
   The Black Arrow

4. Vocabulary:

   Anchor point: A certain spot on the shooter's face which the index finger of the string hand comes to on the draw to give consistency to shooting.
   Arm guard: Protects the arm from the bow string; usually leather and worn on the inside of the forearm.
   Arrow plate: A substance on the side of the bow to give point contact.
   Arrow rest: An extraneous device on the bow to provide point contact; also a resting point.

Back: The side of the bow that is away from the shooter.
Bow arm: The arm that holds the bow and not the string.
Bow sight: A device that allows the shooter to sight directly on the target, which cannot be done with the arrow tip except at point-blank range.
Bow string: The string of a bow, usually made of dacron.
Cock feather: The arrow feather at right angles to the nock; often of a different color than the other feathers.
Draw: To pull the bow string back into the anchor position.
Drawing arm: The arm that draws the bow string back.
Face: That part of the bow facing the shooter. Also, a target face.
Finger tab: Tab worn on the drawing hand to protect the fingers and give a smoother release of the bow string.
Fletching: The feathers of the arrow.
Hand riser: The center part of the bow.
Hen feathers: The two feathers not at right angles to the nock, usually the same color and used along with the cock feather to give guidance to the arrow's flight.
Index finger: The finger next to the thumb.
Instinctive Shooting: Aiming and shooting arrows instinctively, rather than with the aid of a bow sight, pre-gap or point-of-aim methods.
Limbs: The two ends of a bow, from the handle riser out. The limbs bend and give the arrow the spring that propels it.
Longbow: A bow with no recurve.
Nock: The groove in the end of an arrow in which the bow string fits; also the grooves at both ends of the bow, which hold the bow string.
Nocking point: The marked place on the bow string where the arrow nock is placed before drawing and releasing.
Overdraw: Drawing the arrow back too far, so that the tip passes the face of the bow. DANGEROUS.
Pre-gap: A method of aiming.
Point of aim: A method of aiming by using a point, usually in front of the target on which the point of the arrow is placed in line with the eye. This allows for trajectory of the arrow.
Quiver: Something to hold arrows, can be ground, back, or pocket.
Recurve: A bow curved on the ends.
Reflexed bow: A bow with limb ends curving toward the back rather than toward the face of the bow.
Release: To let the bow string slip off the finger tips.
Serving: The thread wrapped about the bow string to prevent fraying of the string.
Shooting tab: A device to protect the fingers of the string hand.
String: To prepare a bow for shooting. Also, the bow string.
Stance: Position assumed in shooting an arrow.
String fingers: The three fingers used to draw back the bow string.
String height: The distance between the bow and the bow string at the handle. (Formerly, "fistmele"-a clenched fist with the thumb raised-was the approximate unit of measure for the correct distance).

PARTS OF A BOW



O.E.E.C. Activity*

INSTRUCTIONAL PROCEDURE

NOTE: Directions will be given for right-handed shooters; left-handers would do the opposite.

The objective of this activity is immediate participation and immediate success. There should be no insistence on perfect form.

1. Have all students at the shooting line and count off by number of bows (4). Assign to targets: first two groups shoot at target #1, next two groups at target #2. Two archers will shoot at each target simultaneously.

2. Place the four ground quivers at the shooting line and have each group line up at a quiver.

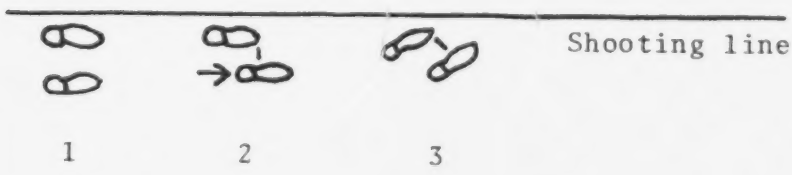
3. Explain and demonstrate the proper placement of the tab.

4. Explain and demonstrate the proper placement of the arm guard.

5. Establish stance by having the students stand at right angles to and with left shoulder toward the target (left-handers stand with right shoulder toward the target). Weight should be evenly distributed and feet as wide apart as is comfortable (approximately shoulder width). Move the right foot forward until the instep of the right foot lines up with the toes of the left foot. Have the students raise up on their toes and take a 1/8 turn toward the target.

Steps in establishing the stance.

Targets



This oblique stance is used because (1) it allows beginners to immediately use the back muscles; (2) it moves the string away from the bow arm so that there is less chance of string slap; and (3) it gives the student a secure base.

6. Bow hold: Have each student extend his left arm toward the target with the left hand in a "handshake" position. Have each student grasp the lower limb of the bow with the right hand, place the pivot point of the bow handle in the "V" formed by the

thumb and forefinger of the left hand, and drop the forefinger around the back of the bow with the thumb resting lightly over the forefinger. The other three fingers should be pointing toward the target. Be sure that the pivot point touches only the meaty part of the thumb and that no other part of the hand or the palm of the hand touches the bow. The extreme of extending the last three fingers toward the target will help the student keep the palm off the bow. This should result in a relaxed hold on the bow, to avoid a "gripping" on the bow handle. The wrist should be straight, but relaxed.

Have the student relax and hold the bow at his side, with the string up so the bow does not interfere with students on either side. Head up, look at the bullseye, raise the bow arm to shoulder height and lower again to the side.

7. Without the tab in shooting position, demonstrate and have the class all do a "Boy Scout salute" (with thumb and little finger touching over the palm and with other three fingers straight). Now establish a hook by pointing the tips of the three string fingers toward the thumb. The first three fingers are then hooked onto the string at the nocking point so that the string lays in the crease made by the first joint of each finger.

    The back of the hand should be kept straight. A cupped hand is incorrect. When the students draw, you will note that the pressure of the string will force the fingers to straighten a little. This is correct. The Boy Scout salute is used to keep the thumb off the arrow, but as students shoot for a while, the thumb and little finger will relax.

8. With the completed unit (bow hold, arm straight down at side, and fingers on the string) have the class raise their heads to look at the bullseye, raise both arms to shoulder level and stop. Have the class draw the bow string 1", relax the fingers and let the string roll off the fingers.

    If you tell the class "1 inch," almost all will draw 3 to 5 inches; if you say "5 inches," they will draw 15 inches.

Repeat this drawing of the string and releasing at least three more times or until the majority of the students have the feel of the release. This can be done while the bow arm remains in position so it is not necessary to go through the whole routine of forming the unit each time.

9. Establishing an anchor: With the draw hand in correct position (but not on the string - Boy Scout salute in hook position) demonstrate and have the students hook the "V" made by the thumb and forefinger behind the jawbone; lay the forefinger along the face so that the tip of the forefinger touches the corner of the mouth, with all three string fingers still in proper hook position.

Explain to the class that archery is a game of consistency and that the anchor point is one of the most important parts of consistency in shooting. An exact anchor establishes the velocity of the arrow as the length of the drawn arrow will determine the number of pounds of the bow that are utilized. Consequently, if the bow were drawn 1" longer one time than another it would impart approximately 2 pounds more energy to the arrow. Raising or lowering an anchor point will have the same effect on trajectory as raising or lowering the rear sight of a rifle.

10. Pracrice draw: Have students assume the stance, establish bow hold, the hook and fingers on the string (again not using tab), straight bow arm, head up, look at the target, draw to anchor and let down.

Prior to giving this instruction, the students should be cautioned to never let go of the bow string at full draw without an arrow, as there is a possibility of breaking the bow.

CAUTION: Never allow an arrow on the bow during this exercise.

Repeat this several times. As the lines repeat the exercise, check each and every student for the path the string is going to travel to be sure that there is string clearance to avoid string slap on the arm. With female students be sure the string is on the outside of the breast. Some students will have a hyperextended elbow or for some other reason it appears that the string will hit the arm. This will be a minority of the group and they should be worked with individually. Two of the common ways to eliminate this problem:

a. Have the student extend the bow arm at shoulder level toward the target; bend the bow arm at the elbow and bring the handle of the bow in to the chest; then re-extend the arm; or, if this does not position the bow properly,
b. Have the student extend the bow arm toward the target at shoulder level and from the shoulder roll the whole arm, including elbow and wrist, until the bow is horizontal to the ground; straighten the bow with just a turn of the wrist without moving the rest of the arm.

11. Nocking the arrow: With the bow hand in place and with the string against the hip, have the students take an arrow from the quiver, holding the arrow at the crest between the thumb and index finger. Push the nock of the arrow onto the string just below the nocking point. The cock feather (odd-colored feather) is away from the bow, and the shaft of the arrow lying on the arrow rest. Be sure that no student holds the arrow with the index finger of the bow hand. (Pinching the nocks makes this unnecessary.)

12. Using the finger tab and with the arrow in place, have the students re-establish the stance, set the hook on the string, with index finger above and next two fingers below the nock of the arrow. Re-establish the bow hold and make sure the bow arm is straight at the side. Talk the students as a group, and in unison, through each of the steps. Head up, look at the bullseye, raise the unit, stop (elbow of the draw arm should be slightly above the plane of the arrow), draw to anchor, and release (thereby shooting an arrow).

> Prior to completion of this first shot, a very short explanation of instinctive aiming should be given but not dwelt upon. It's sometimes helpful to use an analogy, such as: shooting a bow instinctively is much like throwing a baseball; concentrate and focus eyes upon the point you want to hit. Do not look at the arrow or bow, but keep both eyes open.

After shooting the first arrow, talk the students through a second arrow. Have the students in the front of each group go to the back and talk each successive student through two arrows.

> Repetition is extremely important in teaching a person to shoot a bow. The repetition serves as a safety control over the class and gives the students repetitious verbal direction.

If this procedure is followed, all students should have shot a minimum of four arrows in the first 30 minutes.

> In these first few arrows the instructor should be concerned only that the student does not hit his arm and is able to hit the target. The fact that perfect form is not evident is immaterial. At this point emphasis should be on "immediate participation, immediate success."

13. After all students have shot four arrows demonstrate and explain the proper methods of retrieving the arrows from the target and the ground. Have each group assign a target captain whose duty is to withdraw all arrows from the target; two arrow receivers whose duties are to receive the arrows as the captain withdraws them from the target; and an arrow retriever who retrieves arrows that missed the target.

It is each individual's responsibility to pick up all arrows he sees lying on the ground and give them to the arrow retriever. Caution the students to walk slowly to the target and watch for arrows on the ground. Demonstrate that an arrow buried under the grass should be withdrawn point first and be completely clear of the grass before the arrow is lifted.

Explain and demonstrate withdrawing arrows from the target: Place the left hand flat upon the target face with the arrow

shaft close to but not touching the base of the "V" made by the thumb and forefinger. During this operation the person withdrawing the arrows should be standing to the left of the arrow and leaning slightly over the top of the arrow. Grasp the arrow shaft with the right hand at a point closest to the left hand and target and pull the arrow straight out of the target. Be careful not to bend the arrow shaft up or down, right or left.

AN IMPORTANT POINT OF SAFETY: Stress that no one stand in front of the target while arrows are being withdrawn.

After all the arrows are withdrawn, the receivers take the arrows to the shooting line and replace them in the ground quivers.

POINT OF SAFETY: The target captain has the responsibility for each member of the group - it is his job to remain in front of the target until all members of his group have started back to the shooting line.

If the target groups are fewer or more than four people, adjust the target assignments accordingly. After assignments have been made and the withdrawing of arrows has been demonstrated, have the students return to the shooting line.

14. The remainder of this activity should be spent with the students shooting as much as possible with a minimum amount of instruction. The instructor, however, will give personal attention where necessary.

General Safety Points

1. Shoes should be worn on the archery range at all times.

2. Always remember that a "loaded" bow is a deadly weapon.

3. There should be no shooting except at targets.

4. Never show your skill as an archer by using a human target or by permitting anyone to hold a target for you.

5. Use care in handling and carrying equipment. Do not run with arrows held in the hand.

6. One member of a target group should always stand in front of the target while others are looking for lost arrows. If alone, place your strung bow in front of and across the face of the target, to indicate someone is behind the target.

7. In field archery, call "Timber" prior to shooting. Warn others who are walking away from the target at a distance.

8. When an arrow or bow falls in front of the shooting line, caution the student to wait to retrieve it until the persons on each side of him have completed shooting. The bow or arrow must be reached

without interfering with safety. If it can be reached without stepping across the shooting line, the item may be retrieved and shooting continue. An arrow that falls out of reach is considered "shot." During a class it is best to blow a whistle to stop the entire class and have the student pick up his equipment.

9. Hanging arrow on the target: Blow a whistle to stop the class; remove the arrow from the hanging position and insert it back into the target at the correct scoring area.

10. Students should be cautioned to always keep a safe distance behind (or to the side) when arrows are being withdrawn from the target. An arrow suddenly jerked out of the target could cause severe injury.

11. Never use imperfect or inferior equipment, such as cracked arrows, arrows with fletching (feather) or point missing, cracked bows or bows with frayed strings.

12. Never shoot arrows that are too short.

13. Always use an arm guard and finger protector.

14. Always unstring the bow after completing a session of shooting.

15. An archery range should be supervised at all times that there is shooting under way.

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With some editing to suit OEEC purposes, the entire Archery lesson plan was reprinted with permission from "Group Archery Instruction for Beginners," American Association for Health, Physical Education and Recreation (A Department of the National Education Association), 1201 Sixteenth Street, N.W. Washington, D.C. 20036.

Classroom Follow-up

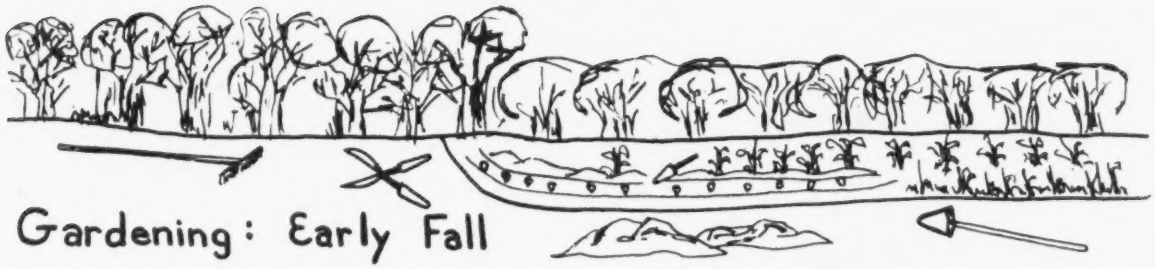
1. Discuss the safety points used at the OEEC and their reasons.

2. Discuss why arrows have feathers.

3. Discuss the books, poems or stories your pupils read and illustrate how the bow and arrow played an important part in them.

4. Invite an archery expert to bring in his equipment and speak to your classes, or in cooperation with the physical education teacher in your school arrange an archery exhibition.

5. Write to the American Archery Council, 100 East Ohio Street, Chicago, Illinois 60611 for information for your students.



Gardening: Early Fall

Classroom Introduction

The garden plot is a good example of how man, through testing, and the careful use of tools he has developed can control his environment and improve upon nature's food producing capabilities.

In a flower bed or garden plot all conditions except climate are controlled so that the plants' fight for survival is less difficult.

a. There is no competition for water and sunlight from other plants (weeds).
b. The soil is prepared for the particular plant.
c. Watering is regularized.

1. Research the growth of agriculture and civilization.

2. Study the crops raised in different parts of the United States and the world and determine why they are grown in a particular area.

3. Films from the Harrisburg School District film library that may relate to this area of study are:
"The Central Farming Region- Food For The Nation," #2138.
"French Farm Family," #2027.
"India - The Struggle For Food," #2150.
"The Orient - Toward A Better Life," #2160.

O.E.E.C. Activity

Between the end of summer camp and the beginning of school the gardens and flower beds at the O.E.E.C. will have become overrun with weeds. Since there is still some growing season left before the first frost, the early fall gardening classes will weed the gardens and flower beds and continue normal garden maintenance.

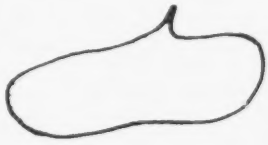
Some vegetables, like tomatoes, will still be able to be harvested, and so restaking the plants and trimming off the none producing stalks, plus hoeing and watering them will be necessary activities.

There will be much landscape gardening to be done also. Trimming the hedges, cutting the grass which the caretaker's tractor mower can't reach, edging walks, picking up sticks and dead branches which have fallen from the large, old trees on the property, gathering seeds like acorns and black walnuts for controlled planting (but not all, the squirrels and chipmunks must eat), picking up litter, and adding all the cuttings and pulled weeds to the mulch pile.

Classroom Follow-up

1. Buy several packages of bulbs or corms. Plant them in window boxes or in plots around your school. Cut some open for your students to examine.

Bulb
Example: Tulip



Corm
Example: Crocus

   A. A bulb is similar to an onion. It has layers and at the base a bud. The layers contain food for the budding plant to use before it can make its own (after it has pushed its way above ground and turns green).

   B. A corm is a solid mass of starchy material (food) with a bud on top.

   C. The bulb or corm will grow in the spring, when the ground has reached the proper temperature and the food has absorbed enough water.

2. Discuss why a bulb or corm can be planted point up or point down and still grow. Make sure some of your bulbs are planted point down. Remember their locations and record your observations in the spring.

3. If your bulbs or corms come in a package, there will probably be planting directions printed on it. If you buy them loose, ask your dealer for tips. The procedure we follow is this:
   1. Use trowel to dig hole to proper depth. Generally for tulips 4-6 inches and for corcuses 2-4 inches.
   2. Put several tiny stones in hole.
   3. Place bulb on stones and cover with soil.
   4. The stones provide drainage in spring and so less bulbs will rot.
   5. Peat moss may be added to each hole before covering with earth, especially in clay like soil.
   6. Spread fertilizer.
   7. Water lightly.

Classroom Introduction

1. Emphasize and discuss the need and reasons for dressing appropriately for this activity.
   A. Long sleeved shirts and long pants will be necessary. Many of the OEEC trails will have "grown over" during the summer and will have to be cut open again. This means the students may be hiking through dense undergrowth at times, which may be spotted with poison ivy, and with multiflora rose, blackberry and raspberry which have "stickers" on them. A light jacket over a short sleeved shirt may be worn in place of a long sleeved shirt.
   B. Shoes which cover the feet are necessary. Sneakers and tennis shoes get wet and uncomfortable very easily in the woods and so are not suitable unless the weather is extremely dry.
   C. If it has rained within three days of your students visit to the OEEC, or if it is raining on the day they visit, the woods will be wet and muddy. When possible, they should wear their own boots. Boots and raincoats are supplied by the OEEC in limited numbers.

2. Discuss observation:
   a. how are the senses involved?
   b. can blind people observe things?
   c. are artists and photographers better at observing things than others?

3. Practice observing things. Test your students powers of observation by holding up a painting or photograph in which there are many things going on. Quickly cover it and have your students make lists of all the things they can remember from it.

4. Try the above experiment with a tape recording or record full of many sounds.

5. Advise your students that you will ask them to list all of the things they can remember from their OEEC experience when they return.

6. Discuss what will happen to animals and plants as the seasons change from summer to fall.

7. Discuss the reasons for this seasonal change.

O.E.E.C. Activity

This is to be a discovery hike which will be oriented by each individual group.

The instructor, however, will try to relate several of the other sixth grade fall activities to it.

There are many amphibians to be found in their natural habitat at the OEEC. Green frogs and tadpoles can be found in the east branch of Spring Creek and salamanders can be seen under rocks almost anywhere on the property.

There is poison ivy of the vine and upright type in many places, and fungi of all sorts in the area.

Insects, of the friend or enemy variety (depending on who you are) abound.

Most importantly there are many things to be seen which fit into a discussion on wilderness ecology, including food chains and natural cycles.

Now and then a fox kill may be spotted, or a decomposing animal carcass, or a tree damaged by tent caterpillars, or a migrating bird unusual to our area, or a honey bee tree, or a fascinating fungus like a bear's head, a fly russula, a giant puffball or a stinkhorn. The list is endless.

Due to the good chance of seeing migrating birds the instructor will carry a pair of field binoculars.

Students will be given bird, wildflower, simple plant, and tree identification books to carry for the groups.

Classroom Follow-up

1. Have your students compose their lists of things observed. See who has the longest list. Combine all the personal lists to make one large class list.

2. Discuss what will happen to the animals and plants that you can see from your classroom window, or that you observe on a walk around your school neighborhood, as the seasons change.

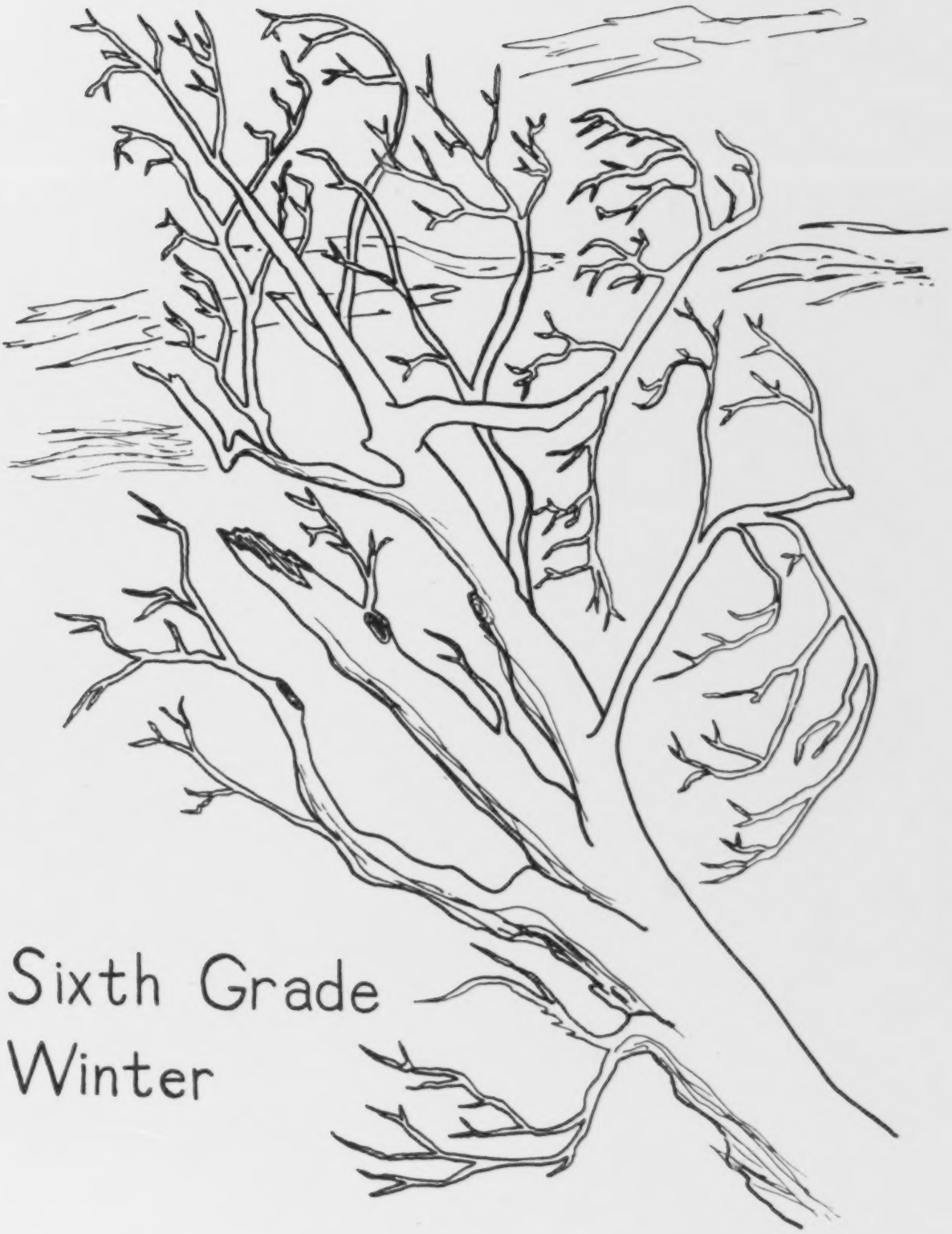
3. Have your students do research on the birds that will migrate from our area, migrate to our area and migrate through our area as the seasons change.

4. Decide if there are any other animals which might migrate to, away or through the Harrisburg area during this season.

5. Collect, press and mount leaves while you study the reasons the leaves change color and fall at this time of year.

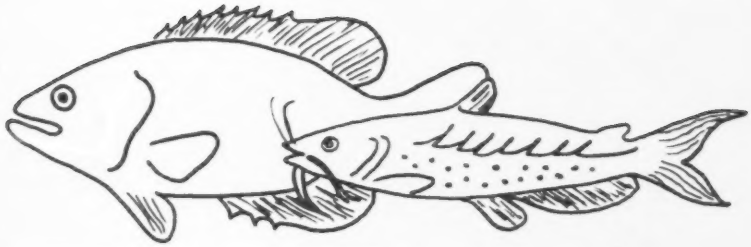
6. List the seasonal vegetables and fruits which the students might eat at this time of year. Bring some in for them to sample.

7. Discuss what farmers do at this time of the year. Invite a farmer in to speak to your classes and answer questions about his work.



Sixth Grade
Winter

FISH



Classroom Introduction

1. Buy a whole fish at the fish market. Bring it to school. Identify it for your students and then talk about where it came from and how it might have been caught. Examine the fish with your students. Look for scales, fins, gills, the shape of its mouth, the shape of its body, its backbone, its air bladder, and the shape of its tail.

2. Discuss the fishing industry and how fish are important in our diets. Investigate what vitamins, minerals and nutrients fish contain.

3. Set up an aquarium in your classroom so that your students can observe fish and their habits. A good size is a 20 gallon long. Some supplies you will need are:
   - A hood with a gro-lux light.
   - A pump, air hose, and filter.
   - Filter cotton or glass wool and charcoal.
   - A heater for tropical fish.
   - Gravel.
   - A fish net.
   - A Ph testing kit.
   - A Thermometer.
   - Live plants.
   - Flake food and a high protein food.
   - Fish- include scavengers, bottom feeders and top feeders.

   For further information contact the OEEC.

4. Set up a goldfish bowl in your classroom. Goldfish are a kind of carp, a very hardy fish. They are easy to take care of.

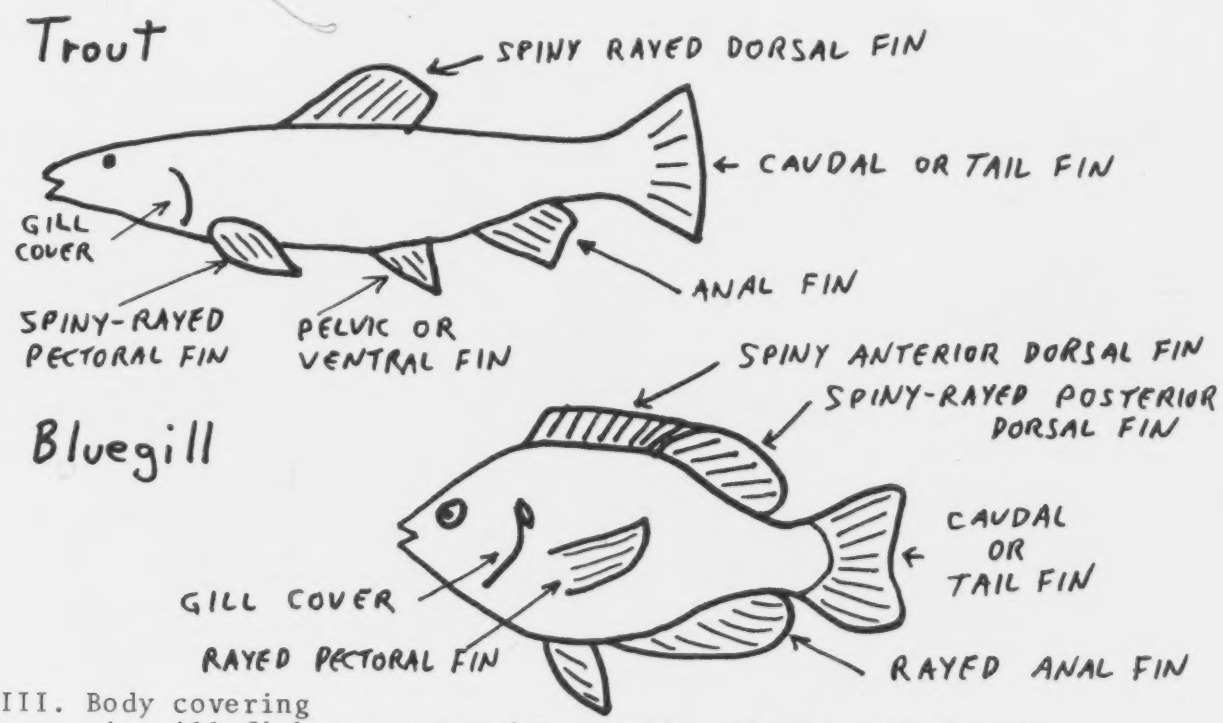
5. Try this experiment.
   Boil enough water to fill your goldfish bowl. Cool the water to room temperature. Place your goldfish in the freshly cooled, boiled water. The fish will seem uncomfortable in the water and soon come to the surface, stick his head out and swallow air. By boiling the water, you took out all of the oxygen. Discuss the results with your students.

O.E.E.C. Activity

The fish room will be set up with aquariums containing native cold water fish and various tropical fish. There will also be fish specimens in bottles and charts showing Pennsylvania game fish and the fish's place in the web of life. For much of the time the classroom will be darkened with only the lights in the aquariums being used for illumination.

I. Characteristics of fish.
   A. Cold-blooded- They acquire the temperature of the water surrounding them.
   B. They are vertebrates.
   C. They have fins to propell them.
   D. They have gills for breathing.
   E. Most have scales, but some are slimy-skinned.

II. Shapes
   1. Rounded like the Trout.
   2. Compressed like the Bluegill.



III. Body covering
   A. All fish are covered by a slimy liquid called mucus.
      1. Mucus is formed by glands in the skin.
      2. It helps keep the fish free from infection.
   B. Most fish have scales.
      1. A smooth-skinned fish like the Trout has tiny scales which fit deeply into their skin.

2. Bass have large scales with spines on the outer edges.
3. The age of a fish can be found by counting the growth rings on its scales, just like rings on trees.

IV. Breathing
A. Fish get oxygen from the water by use of their gills.
1. The gills are made up of a tiny network of blood vessels.
2. The gill walls are so thin that they allow oxygen and carbon dioxide to pass through easily.
3. By opening and closing its mouth the fish forces water over its gills. This helps it to breathe.

V. Types of Food
A. Fish with rough mouthes like Trout, Muskelunge and Pickerel usually eat other animal life.
B. Fish with soft mouths usually eat plants or other soft food.

VI. Reproduction
A. All fish spawn in their native birthplace.
1. Most eggs are usually laid in the bottom of streams or lakes, however, some fish prefer sunken tree stumps and roots.
2. The female lays her eggs in a place that she and the male have cleared.
3. The male deposits his sperm over the eggs and they are then fertilized.
4. The young are born as small adults in approximately 10 days.
5. Some are eaten by larger fish in the area.
6. Usually only a few escape to become full grown.

Classroom Follow-up

1. Discuss what part fish play in nature's food chain.

2. Discuss the effects of pollution on fish and what this means to us.

Example: The Tuna and Swordfish mercury problem.

3. Find out what fish used to live in the Susquehanna River and what fish live there now. Discuss why the fish population in the Susquehanna River has changed.

4. Many materials including pamphlets, charts, and movies can be obtained from the Pennsylvania Fish Commission, 3534 Walnut Street, Harrisburg. One useful pamphlet is "Fish Facts."

5. Find out what a Waterways Patrolman (Fish Warden) does. Invite one in to speak to your science classes.

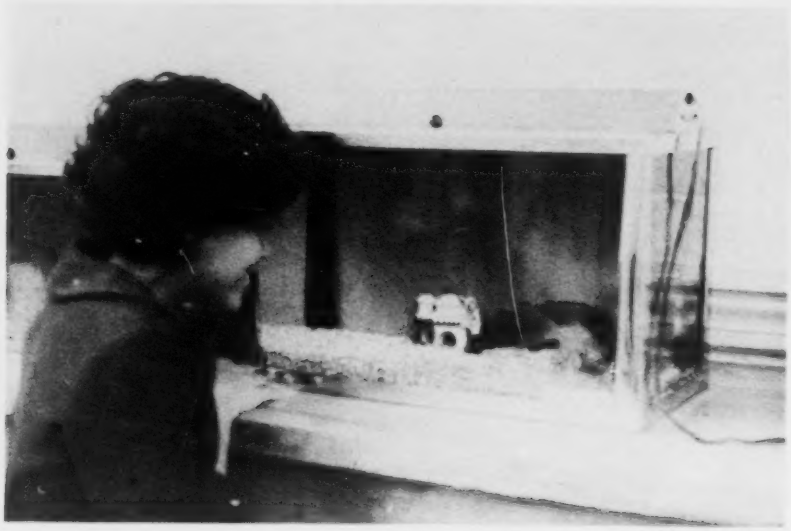
6. Visit a fish hatchery.

7. Films from the Harrisburg City Schools film library relating to this lesson are:

   "Aquarium- Classroom Science"
   "Fish Are Interesting"
   "Snails- Backyard Science"
   "The Ocean- A First Film"

8. Suggested reading:

   "The How And Why Wonder Book of Fish," by Geoffrey Coe, Wonder Books, New York.



Invertebrate Animals

Classroom Introduction

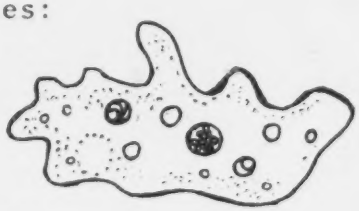
If a microscope is available (even most inexpensive toy microscopes will do), take some hay or straw and put a handful in a jar of water in the sun for a few days, until bubbles and organic matter begin to form. A drop of mucky water from this jar will yield hundreds of one-celled animals to watch on a glass slide (use a cover-slip) under a microscope.

O.E.E.C. Activity

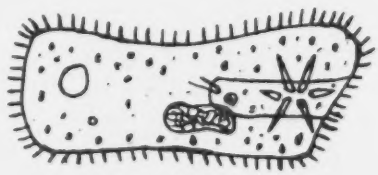
The more than two million different kinds of animals in this world have been divided by scientists into ten main groups, called phyla. Only one of these groups, the chordata, numbering 45,000, has backbones. The other nine phyla are all invertebrates: animals without backbones.
Listed here are the nine groups of invertebrate animals.

1. PROTOZOA- There are nearly as many of these kinds of animals as there are all backboned animals (vertebrates). These are all "one-celled" and usually are seen only with a lens. They can form colonies or be free swimming. Some are disease carriers.

   Examples:



amoeba



paramecium

2. SPONGES- These animals grow as colonies of cells attached to the bottom of their water home. They take in particles of food that floats by through "pore" openings. There are three kinds, formed of lime, silica, and spongin (the kind once used in households).

3. COELENTERATES- These are the jellyfish, corals, hydra, and "sea flowers" or anemones. Some have special stinging cells to capture their food. They may swim free like a jellyfish, or attach to the ocean floor, like coral colonies.

4. FLATWORMS- Worms with flattened bodies, such as the famous "cross-eyed" planarian. This group includes parasites like tapeworms and flukeworms, dangerous to humans who eat undercooked or raw meats and fish.

5. ROUNDWORMS- These worms are not flattened, but have smooth, rounded body forms. As with the flatworms, many are parasites to man. This phyla includes intestinal roundworms, hookworms, and trichina worms, which live in human muscle tissue.

6. SEGMENTED WORMS- The annelids include the most familiar worms, such as the earthworms, leeches and sandworms. All have dozens of dividing "rings" around their bodies, making them "segmented," and giving the earthworm its peculiar rough feeling. The earthworm is very beneficial to man.

7. ECHINODERMS- These are the "spiny-skinned" animals such as the starfish, sand dollar and sea urchin. One type, the sea lilly, lives attached to the ocean floor and looks like a flower. All have hard "spiny" outer skins. Except for the sea lilly, they move about on dozens of tiny "tube feet," with suction cup tips. Their "eyes" are merely light sensitive spots that can tell light from dark.

8. MOLLUSKS- This is a strange animal group of five different classes. Except for the land snails and slugs they are aquatic.
   a. Chitons- These are the tiny "lady slipper" type shells which cling to the underside of rocks. Important as a food source to man.
   b. Tusk shells- These are the shell animals roughly shaped like an elephants tusk.
   c. Bivalves- They are the famous hinge-shelled animals including the clam and oyster. They have a "siphon" to carry water in and out over the gills and a "foot" to dig into the sand.
   d. Gastropods- These are the snails and slugs and other spiral-shelled or shell-less gastropods of land and sea. Land snails make interesting pets.
   e. Cephalopods- These are the squid, octopus and chambered nautilus. Though the inside is like a clam, the octopus has an eye almost like a human being.

9. ARTHROPODS- This group includes over half the known animals in the world, mostly because it includes the insects. All have segmented (sectioned) external exoskeletons and jointed legs. They are the:
   a. Centipedes- Have one leg pair on each body segment.

b. Millipedes- ("1,000 leggers") Have two leg pairs per segment.

c. Crustaceans- In this group the head and thorax (unlike the insect) are fused into one cephalothorax. They include the lobsters and crayfish, shrimp, cyclops, barnacles, crabs, sow bugs, and many more.

d. Arachnids- These are the spiders, scorpions, daddy-longlegs, ticks, mites and the "living fossil" the horseshoe "crab." They have eight legs and a cephalothorax.

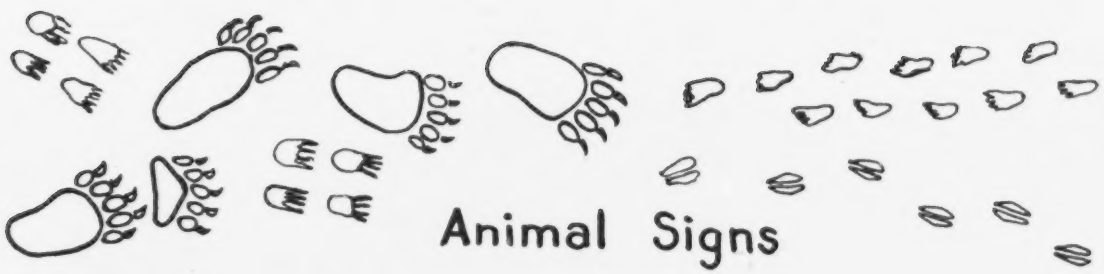
e. Insects- Insects have a head, thorax and abdomen, three pairs of legs, one pair of antennae, and usually, one or two pairs of wings. There are over a million different kinds.

Classroom Follow-up

1. See how many of the nine phyla of invertebrates can be collected by your class. A pictorial check list will be encouraging. Soft-bodied forms can be preserved in alcohol. Hard bodied or shelled forms should be sun dried.

2. Films from the Harrisburg City Schools film library which can be used with this activity are:

"The Protect Kingdom"
"Snails- Backyard Science"
"Coral Reef"
"Echinoderms And Mollusks"
"Sea Shell Animals"
"What's Alive"



Animal Signs

Classroom Introduction

It is often difficult to observe wild animals in their natural habitat. They are afraid of people and many are nocturnal. A great deal of information about which animals live where, and what their life is like, however, may be obtained by observing signs they have left behind them. This type of observation is a kind of detective work used by Indians, Eskimos and good woodsmen everywhere. It doesn't have to be limited to outdoorsmen, or to "natural areas" though, as there are many animal signs to be found in city neighborhoods, too.

1. Have the class list as many animal signs as they can think of that they can see in their own neighborhoods. Include signs of man. These can be such things as tracks and footprints in dust and snow, feathers, bird droppings, nests, litter, cars, and even buildings.

2. Discuss what can be learned from animal signs. Things such as where people and other animals live, how they travel and where, what they eat, and what their shelter requirements are.

O.E.E.C. Activity

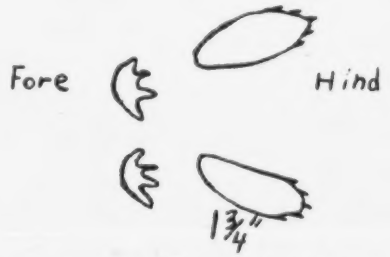
A hike will be taken in order to search for signs of animals. Some of the animals whose signs may be observed will be squirrels, rabbits, mice, birds, insects and domestic dogs and cats. Some of the things will be; tracks in snow, dust or mud; nests, dens and den trees; gnawings and other evidence of eating; droppings; animals trails; and egg cases and cocoons.

The meanings of the various signs seen will be discussed. What animal left a sign here? What was he eating? Where was he going? Is he cold-blooded or warm-blooded? Was he going quickly or slowly?

A brief description of some of the animal signs that we will observe follows.

1) Eastern Gray Squirrel

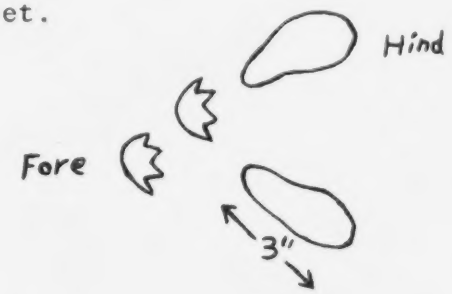
Tracks: paired tracks with hind feet in front of fore-feet.



Eating: Gnaws bark on conifers and eats nuts and buds. Makes two distinct holes on a nut, one on each side. Can find nuts which it has buried, even when snow is on the ground, through its keen sense of smell.
Shelter: Stays in holes in trees in bad weather. Large summer nests made of leaves and twigs may be seen in the tops of trees.

2) Cottontail Rabbit

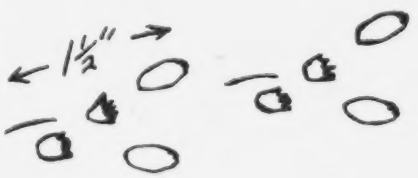
Tracks: hind feet in front of fore-feet.



Eating: In winter they often gnaw bark and twigs, eat buds and needles of evergreens and dry weeds.
Droppings: We often see their, small, round pellet-like droppings, especially in the snow.
Shelter: They hide in hollow logs, stumps, burrows or crevices in rocks, or nest in a brush heap or tangle of vines.

3) Meadow Mouse

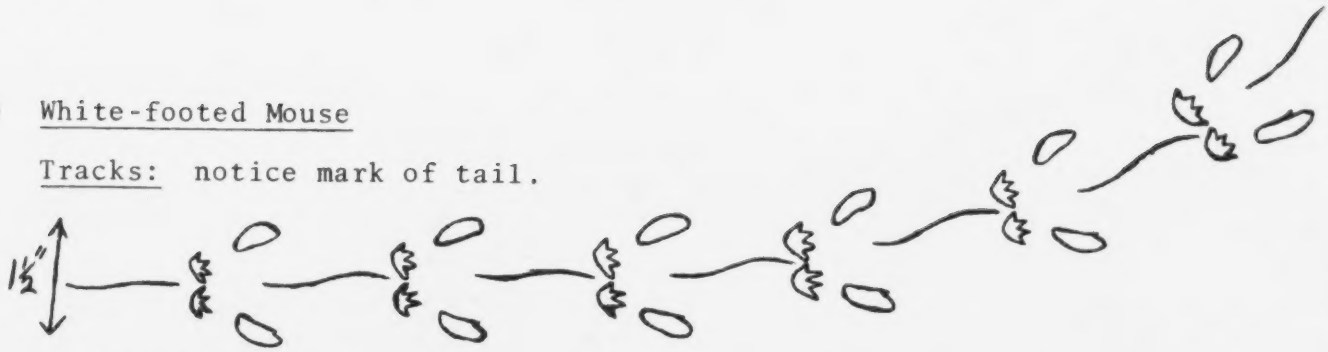
Tracks:



Eating: seeds, stems, roots and bark
Shelter: They make runways in the heavy grass, and when there is snow, they tunnel underneath it. These tunnels, with the grass neatly clipped off by the mice, can be traced to the winter nests, which are built out of dry grass on the surface of the ground.

4) White-footed Mouse

Tracks: notice mark of tail.

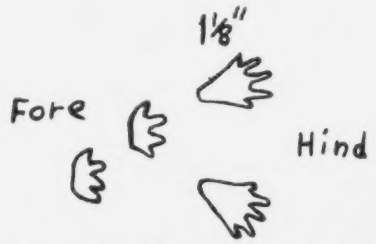


Eating: store seeds, acorns and berries for winter use, although they are active all winter.

Shelter: They nest in logs and stumps, in abandoned birds nests or even abandoned wasp nests.

5) Chipmunk

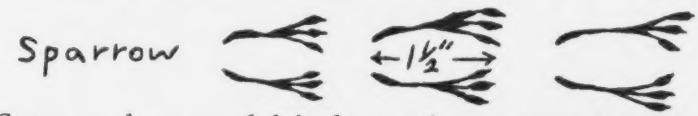
Tracks:



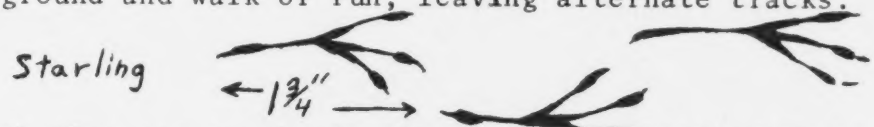
Eating: nuts, fungi, berries, weed-seeds, tree-seeds, slugs, insects, small snakes.

Shelter: Underground burrows which they retreat to in cold or hot weather. Entrance to the burrow may be under grass, or at the base of an old tree or stone wall.

6) Birds: Perching birds: these hop and leave paired tracks.



Game and ground birds: these spend much of their time on the ground and walk or run, leaving alternate tracks.



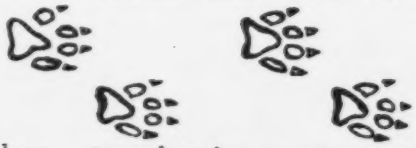
Along with pheasant tracks in the snow there will often be feather marks where the bird swept the snow with its wings as it took off in flight.

Shelter: We will look for woodpecker holes in trees and last year's nests of other birds, noting that each type of bird makes a distinctive type of nest, specifically located.

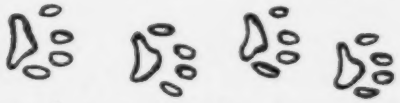
Eating: We will look for possible food sources for winter birds, such as goldenrod heads, and then look for bird tracks near them.

7) Domestic dog and cat

Dog tracks: tracks not in a straight line, toenail marks apparent.



Cat tracks: tracks in a straight line with no toenails showing, as the cat pulls his claws in as he walks.



Both dog and cat tracks are commonly found in the O.E.E.C. woods, as these animals hunt rabbits, mice and birds there.

8) Insects

We will look under stones and logs for hibernating bald-faced hornet queens and other dormant insects. We will search for tent caterpillar egg cases, praying mantis egg cases and moth cocoons. Abandoned hornet nests will be apparent.

Classroom Follow-up

1. Make a bulletin board with pictures of the various animals whose signs you saw at the O.E.E.C. Draw pictures of the signs to pair with them.

2. Go outside and look for animal signs around the school building.

3. Bibliography

Selsam, Millicent, How to be a Nature Detective - A simple, beginning book on animal tracks.

Buck, Margaret, Where they Go in Winter - A quite comprehensive work on the habits of animals in winter.

Murie, Olaus, A Field Guide to Animal Tracks - This is a classic. It tells much more about an animal than his tracks. Well illustrated, it describes nesting and eating habits in detail.

PLANT DIFFERENCES

Classroom Introduction

1. Review I. A and B of the classroom introduction to "Observation Hike: Plants Reaction to Seasonal Change," a fourth grade fall lesson plan.

2. Review the functions of the parts of flowering plants.
   1. Roots
   2. Stems
   3. Buds
   4. Leaves
   5. Flowers
   6. Fruits
   7. Seeds

3. Have students or groups of students do research on products derived from plants. Some examples: cotton, rope, rubber, pitch, tar, turpentine, alcohol, resin, coffee, gum, cola, tea, tobacco.

4. Discuss the following questions.
   A. What makes a tree a tree?
   B. How can we tell a tree from a bush?
   C. What's the difference between a bush and a vine?

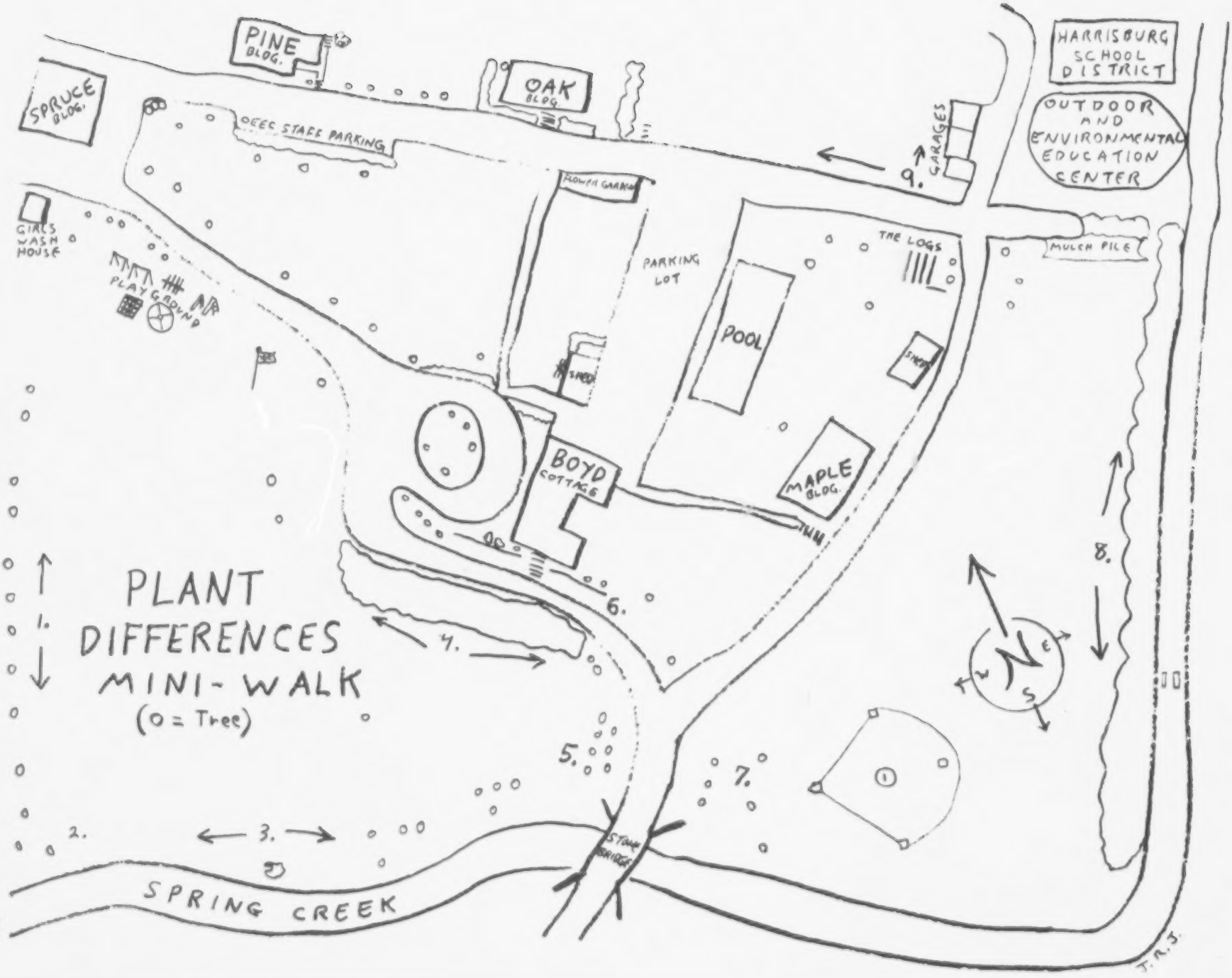
O.E.E.C. Activity

In the winter it is easy to study the form and structure of plants because they are not hidden from view by the leaves. Also, plants can be identified by their different barks, buds and leaf scars.

The instructor will walk with the group pausing at each station on the sketch map long enough for the students to examine the plants growing there.

Plant Differences Mini-walk (Refer to OEEC sketch map)

Station I
The row of trees bordering the OEEC property contains oak, Kentucky coffee bean, white pine, ash, and elm.


PINE BLDG.
SPRUCE BLDG.
OAK BLDG.
HARRISBURG SCHOOL DISTRICT
OUTDOOR AND ENVIRONMENTAL EDUCATION CENTER
OEEC STAFF PARKING
FLOWER GARDEN
9. GARAGES
GIRLS WASH HOUSE
PLAYGROUND
PARKING LOT
THE LOGS
MULCH PILE
POOL
BOYD COTTAGE
MAPLE BLDG.
PLANT DIFFERENCES MINI-WALK
(O = Tree)
1.
2.
3.
4.
5.
6.
7.
8.
SPRING CREEK
STONE BRIDGE
N
E
S
W
T.R.S.

Station 2
Willow tree, various shrubs like Japanese knotweed, nightshade.

Station 3
Along Spring Creek. Mulberry shoots, barberry, wild raspberry, poison ivy, elm trees, milkweed, violets, nightshade, wild aster, dandelion, grasses.

Station 4
The steep bank alongside the road below Boyd Cottage. Multaflora rose, catnip, milkweed, walnut, maple, honeysuckle, a copper beech and a weeping beech.

Station 5
A stand of pine and spruce trees.

Station 6
The front and east side of Boyd Cottage. Black walnut, tulip poplar, white pine, and hemlock(Pennsylvania State Tree), iris, boxwood, mockorange, Boston and English ivy.

Station 7
Larch, birch, Kentucky coffee bean, and hornbeam trees.

Station 8
The Creek bank at the old dam along the eastern property line. Black locust, hawthorn, poison ivy, honeysuckle, grasses.

Station 9
The dirt bank above the wall along the road from the garages to Oak Cottage. Elms, maples, honeysuckle, wild aster, catalpa, grasses, privet, milkweed, pine seedlings.

Classroom Follow-up

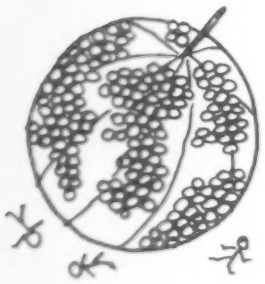
1. Send to the Pennsylvania Department of Forests and Waters, Harrisburg, for the booklet "Common Trees of Pennsylvania" for your students.

2. Take a walk around your school building or neighborhood. List and classify the plants you find. Point out to your students the different buds on the trees and the different shape of each variety of tree.

3. Draw a map of your school neighborhood. Include the plants you found on your walk.

4. Films:

"Plants Live Through The Winter"
"Plants Are Different And Alike"



HUMAN ECOLOGY and POPULATION

Classroom Introduction

Serious studies of man's effect on the environment conclude that over-population is the original cause of pollution.

Ecologists speak of the carrying capacity of a certain area of wilderness. This means a certain amount of land can support a certain amount of each species of animals.

Spaceship Earth may have already reached its carrying capacity in terms of supporting all of its present population at a standard of living equivilent to middle class Americans in 1972.

1. Modern medical knowledge is saving more lives today than ever before. Have your students take turns telling the class their medical history. When all have finished, try to figure out how many of your students would not have been alive 100 years ago.

   Try this one in the faculty lounge for some startling results.

2. Discuss with your students what science class would be like, if suddenly the amount of students in your room were doubled, or halved, or quartered.

3. Recommended reading for teachers:

   "The Population Bomb," Dr. Paul R. Ehrlich
   "How to be a Survivor," Dr. Paul R. Ehrlich
   "Moment in the Sun," Robert and Leona Train Rienow

O.E.E.C. Activity

I. Discussion of the population explosion.
   A. Causes
      1. Improved medicine
         -more sick persons of today get well then did in the past.
      2. Improved sanitation
         -the plagues of long ago have been eliminated and disease has been reduced.

3. Improved nutrition
   -people are better able to resist sickness.
4. Decreased infant mortality
   -more babies live to be adults.
5. Increased longevity
   -more people occupy the earth longer.

B. Dangers
1. Lack of food
   -as the world becomes more densely populated, food supplies will dwindle and many people will starve to death.
2. Overcrowdedness
   -pressure on people causes crime and violence.
3. Pollution
   -more people use more energy, create more sewage and waste resulting in air, water, and land pollution.
4. Resource depletion
   -more people require more goods resulting in a search for non-renewable resources which could destroy the land.
5. The possibility of economic wars for resources.

C. Remedies
1. Control population growth
   a. Birth control
      -limit the number of births to equal the number of deaths
   b. War
      -an inhumane and, historically, an ineffective means of reducing population.
   c. Move to other planets
      -a remote possibility because none in our solar system are capable of supporting human life.
2. Increase food supply
   a. cultivate more land
   b. use the resources of the sea
   c. increase yields per acre
      -involves using fertilizers and pesticides which result in more pollution
3. Use fewer resources
   a. recycle resources already used
   b. make more things by hand
      -could provide more jobs
   c. build things to last longer

D. Problems associated with population control
1. Religious objections
   -some religions do not permit birth control
2. Social objections
   a. in some areas people have more children to help farm the land
   b. some people have children just to get more welfare
3. Ignorance and poverty
   -some people just don't understand the problems of over-population
4. Many businesses favor population growth
   a. more people buy more products
   b. more people use more resources

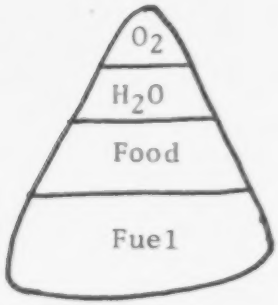
II. Observation of overpopulation on mice
   A. Two aquariums of the same size will be set up for mice.
      1. aquarium A will have many mice.
      2. aquarium B will have a mated pair.
   B. Aquarium A will be overcrowded. If conditions remain unchanged;
      1. no babies will live. They will be eaten by the adults.
      2. there will be much fighting and now and then a mouse will be killed or die as a result of wounds received from others.
      3. the weaker mice will die.
      4. the aquarium will need cleaned very often.
      5. the aquarium will require much food and water.
      6. if food is not received, cannibalism will occur.
   C. Aquarium B will not be overcrowded
      1. babies will be cared for by the adults.
      2. there will be no fighting.
      3. mice will die of old age.
      4. each mouse will receive a fair share of food and water.
      5. aquarium B will stay clean longer then aquarium **A**.
      6. there will be no cannibalism, when food is withheld for the same amount of time as for aquarium A.

III. To illustrate the pressures of a growing population on a finite planet:
   A. Lay out a 3 x 4 ft. rectangle representing the constant amount of space available on the earth.
   B. Have twelve students stand in the rectangle one by one until they are all occuping the 12 square feet.
   C. Allow them to stand there for 1 or 2 minutes of unrestricted activity.
   D. Discuss how they felt as the "population" grew to overcrowdedness.

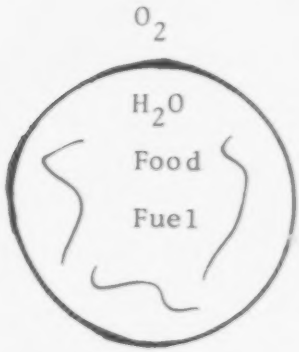
Classroom Follow-up

1. Useful statistics:
   a. A child is born every 9 seconds in America. This means:
      - 360 babies each hour
      - 8,640 each day
   b. Each individual will consume in their lifetime:
      - 9,000 lbs. of wheat
      - 10,150 lbs. of meat
      - 56,000,000 gallons of water
      - 28,000 lbs. of milk and its by-products
      - 100,000 lbs. of steel
      - 1,000 trees
   c. In a lifetime each consumer will produce 150,000 lbs. of garbage!

2. Draw two spaceships on the chalkboard. Label one Apollo, and the other Earth.



Spaceship Apollo



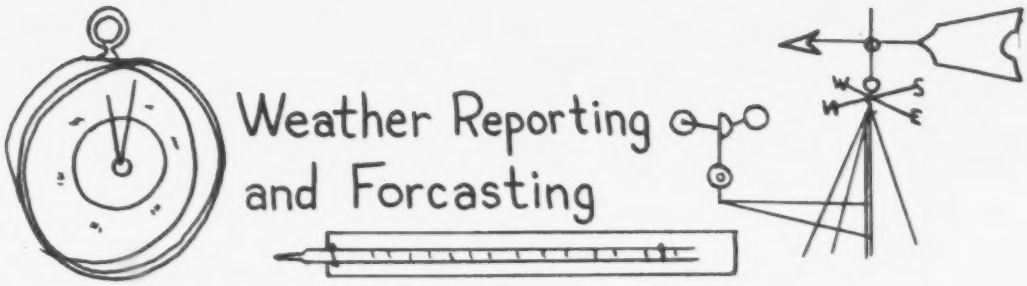
Spaceship Earth

Establish a corelation between the two by showing that, if either runs out of all their oxygen, their water, their food or their fuel they will have major problems. Discuss what could occur to either spaceship with your students.

3. In a discussion of population include the following:
   a. consumerism
   b. pollution
   c. nonrenewable resources
   d. birth rate
   e. death rate
   f. infant mortality
   g. increased medical knowledge
   h. food supplies and nutrition
   i. sanitation
   j. energy requirements
   k. taxes
   l. water requirements

4. For further information write to:

   Zero Population Growth
   367 State Street,
   Los Altos, California 94022



Classroom Introduction

1. Collect and review daily weather reports from newspapers.

2. Mount a thermometer outside your school and record temperatures at the same time each morning and afternoon for one week. Discuss.

3. If you have a barometer available, or a student can bring one in, record changes in pressure and watch weather reports for any relationships for a period of at least one week. Discuss.

O.E.E.C. Activity

Objective: To see and study some weather instruments and learn how they measure and record changing conditions in the atmosphere. This activity will be presented in three parts.

1. A brief review of weather conditions.
2. Seeing and reading the weather instruments at the OEEC "Weather Station."
3. Recording instrument readings on the weather station chart using outside readings only. This will be done throughout the activity.

I. Review of weather conditions using the chalk board.

(Weather is changes in the atmosphere.)

A. Wind- moving air.
B. Temperature- heat in air.
C. Humidity- water vapor in air.
D. Air Pressure- weight of the air.
E. Sky Conditions- cloudiness or clearness.
F. Precipitation- forms of water falling back to earth.

II. Weather Instruments:

A. Wind- moving air.

*WIND VANE- direction indicator.

*ANEMOMETER- wind speed indicator.

1. These instruments are mounted on the west end of the roof of Pine Cottage and are connected by electric cables to instrument dials in the weather station.
2. The Wind Vane points into the wind. The instrument dial indicates the direction from which the wind is blowing.

B. Temperature - heat in the air.

THERMOMETERS- indicate change in air temperature in degrees.

1. Compare readings on *Inside-Outside Thermometer. The outside half is connected to a sensor mounted outside Pine Cottage.
2. Minimum-maximum Thermometer, which should have been outside overnight, will indicate the lowest overnight reading. During the school day it is mounted in the weather station.
3. *Recording Thermometer- on right top shelf in weather station. Connected to outside sensor. It records on its chart continuous readings for the week. Charts from past weeks denoting daily highs and lows and seasonal changes will be passed around. This instrument is also called a Thermograph.

C. Humidity- water vapor in air.

WET-BULB THERMOMETERS- indicate how fast evaporation is occuring. When compared with the air temperature, the percentage of relative humidity can be calculated. 100% humidity is all the vapor air can hold.

1. Hygrometer- removable from wall mount with wet-bulb wick suspended in container of water. Use the calebrated dial to obtain per-centages of relative humidity after subtracting wet-bulb reading from dry-bulb reading.
2. Sling Psychrometer- lying on weather station shelf with attached chain. Can be used outside if care is taken not to let it strike anything. Use chart mounted in weather station to find relative humidity.

D. Air Pressure - weight of the air.

BAROMETERS- indicate changes in the weight or pressure of the air over us.

1. Aneroid Barometer- mounted between wind speed and wind direction instruments. The manually set needle is placed over the indicator needle so changes can be noted later. (The manually operated needle will be set at the end of each school day so changes may be read on the instrument).

2. Recording Barometer- on left of top shelf in weather station. It records continuous air pressure readings for a week. Weekly charts will be distributed. Using these charts the students will be able to note that pressure changes preceeded most weather changes. The collection of daily weather reports will be used for comparison.
3. Mercury Barometer- air pressure holds up a column of mercury in a tube marked in inches. Our other barometers are calebrated with this same inch scale even though they operate differently.

E. Sky Condition- cloudiness or clearness.
One or more students will look at the sky and describe it for the group.
*Sky Condition terms used may include:
Sunny- clear with sunshine.
Mostly sunny- scattered clouds, sunshine.
Cloudy- much cloud cover.
Mostly cloudy- some clear sky.
Clear- no clouds, with stars out at night.
Smog or Haze- fog mixed with air pollution.
Mist or Fog- clouds at ground level.
NOTE: See newspaper forecast marked "Sun" or "Clouds."

F. Precipitation- forms of water falling back to earth. Precipitation only occurs when weather conditions are such that rain, snow, sleet, or hail are formed and reach the earth's surface before evaporating again.
1. Rain gauge- mounted in lower left section of weather station. It collects rain on the roof through a copper tube. It is calebrated to read hundreds and tenths of inches of rainfall. 10 inches of snow averages one inch of rain. It should be read, recorded and replaced dry regularly. Ours is emptied each Friday afternoon.

III. Recording instrument readings.
A. The weather station chart may be used to record some instrument readings. A rag to clean off old readings and a special marking crayon will be provided. (*) - indicates items that may be recorded on our chart. "Weather" means the general weather discription such as fair, stormy, etc.

B. Use chalk board for all other readings:
1. Minimum-maximum temperatures.
2. Humidity.
3. Barometric pressure.
4. Type and amount of precipitation, if any.

IV. The instructor will advise the students that much information is used in reporting and forecasting weather conditions and that we have only a few of the instruments available to professional weather services. Weather satelites, for instance, circle the earth taking pictures. Copies of these photos may be available for student examination.

Classroom Follow-up

1. Encourage students to make a rain gauge, wind vane or other weather instrument for use at school or home.

2. Keep a record of daily high and low temperatures for a month or longer.

3. Record daily humidity using a home made barometer.

4. Record and learn types of clouds seen daily from classroom window.

5. Check your library for cloud charts, science project guides, filmstrips and etc.

6. The National Weather Service, Room 1100, Federal Building, Third and Walnut Streets, Harrisburg 17108 has weather charts available to teachers. These charts, sent out over a wire from the Map Center in Washington, D. C., would be several days old, but would illustrate for your students the kind of information used for weather reporting and forecasting.

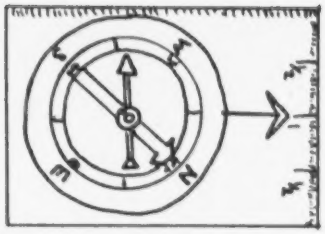
7. The number to call in the Harrisburg area for an up-to-the-minute weather report and forecast is 782-4432.

8. Vocabulary:

Weather	Precipitation	Vapor	Humidity
Report	Pressure	Mist	Barometer
Forecast	Atmosphere	Hygrometer	Anemometer
Condition	Haze	Psychrometer	Thermometer
Temperature	Smog	Thermograph	Gauge

9. Films from the Harrisburg City Schools film library applicable to this lesson are:

"Clouds"
"Snow- A First Film"
"A First Film On The Wind"
"Weather For Beginners"
"Let's Learn To Predict The Weather"
"Weather- Understanding Storms"
"Weather- Why It Changes"



COMPASS

Classroom Introduction

1. Look up "Compass Magnetic" in an encyclopedia:
   a. Review what is known about the history of the compass.
   b. Decide from the information given how accurate magnetic compasses are.
   c. Find out what changes have been made in modern compasses.
   d. Study the word "degree" in reference to the compass.

2. Draw a simple map of your school building and grounds marking the directions North, South, East and West on the map.

O.E.E.C. Activity

I. The Compass: an introduction to understanding.

A. Suspend a piece of magnetite on a woven, braided or monofilament cord and allow it to come to rest.
   1. Note that it alignes itself in the same position each time.
   2. Mark the edge pointing North with chalk.

B. Perform the same experiment with the following materials:
   * Iron ore sample
   * Sandstone
   * Block of wood
   * Bar magnet
   1. See which materials come to rest in the same position each time and which do not.

C. Float a small magnetic compass needle on a cork or piece of wood in a bowl of water.
   1. Place the bowl on a large piece of paper.
   2. Mark the direction the needle points each time it comes to rest.

D. Try experiment C with an ordinary nail. Observe the results.
   1. Now holding the nail in a flat North-South position, strike it sharply with a hammer.
   2. Try the experiment again. Have you made a magnetic compass needle?

E. Try C again with an ordinary unmagnetized nail.
   1. Now stroke the nail from end to end with one end of a bar magnet.
   2. Next float or suspend the nail to see if it has become magnetized and can be used as a compass.

II. Distribute the compasses and explain their use with the large demonstration model Silva Type Compass.

A. Orient compasses with North.

B. Point out major directions:

North 0^o or 360^o

East 90^o

South 180^o

West 270^o

C. Set the "Direction of Travel" arrow to <u>follow</u> a known direction. (For use with Silva Type Compasses).
   1. Set the known degree reading at the base of the Directions of Travel Arrow by turning the Compass Housing.
   2. Hold the compass with the Direction of Travel Arrow pointing to the front.
   3. Turn your body until the red end of the Magnetic Needle is pointing to the "N" for North. Note: The red and white magnetic Needle will then be directly over the outlined black arrow in the base of the Housing. Note: Since the Magnetic Needle always points North, it does <u>not</u> point the way to go unless the course calls for 360^o or 0^o which is North.
   4. Look up and forward in line with the Direction or Travel Arrow and sight on an object such as a bush or tree in line with it.
   5. Forget the compass and walk toward the object sighted. You then will have found and be going in the direction called for.

D. Use the "Direction of Travel" arrow to <u>find</u> an unknown direction. (For use with Silva Type Compasses).
   1. Point the Direction of Travel Arrow toward the place or object for which the direction is unknown.
   2. Allow the Magnetic Needle to indicate North while holding it level.
   3. Turn the Compass Housing so that the "N" for north is lined up at the red end of the Magnetic Needle. Notice also that the outlined black arrow is directly below the red and white Magnetic Needle.
   4. Now read the degrees lined up with the base of the Direction of Travel Arrow, unknown direction you are seeking.
   5. Select objects for all students to practice with until they are successful.

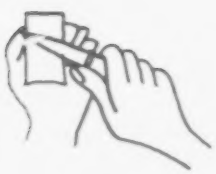
Classroom Follow-up

1. Have your students make a compass in science class.
   a. Magnetize a straight pin or small nail by stroking along its length with a bar magnet.
   b. Pass the pin through a small cork or lay it on a disk of wood or styrofoam.
   c. Float it in a bowl **or** cup.
   d. Mark the edge of the container with degrees and the major points of the compass.

2. Ask your students to bring in any compasses they may have at home.
   a. Discuss the variety of compasses collected. Notice that they all have a Magnetic Needle or Magnetized Compass-point card free to swing on a pivot point.
   b. All modern compasses are marked with 360 degrees. You may find an older compass marked with the 32 points of the Mariners Compass. Some one may want to learn to "box the compass" by learning to name the points of the compass clockwise. (See "Compass-card" in an unabridged dictionary).

3. Vocabulary:

   Degree
   Magnet
   Magnetic North
   Magnetite



TOOLS
Care & Sharpening

O.E.E.C. Activity

Objective: To give every student an opportunity to practice care and sharpening techniques on actual tools under the direction of a competent instructor.

I. Tool Care
- There are several rules for keeping tools ready to do the job which are applicable to any metal tool:

A. Always Use The Right Tool For The Right Job.
B. Keep tools clean, dry and sharp.
C. Don't use them on things that will dull or break them.
D. Keep them off the ground - moisture and dirt will ruin them.
E. Keep them out of a fire - the heat draws the temper of steel and makes edges soft and useless.
F. Wipe tools clean after using them and oil any moving parts occasionally.
G. Remove rust and corrosion with oil, steel wool, and emery cloth.
H. Always return a tool to its proper place when you are finished with it - It Saves Time The Next Time.

II. Tool Sharpening
- Remember: A dull tool is a dangerous tool.

A. Two types of sharpening stones can be used.
   1. Wet Stone (oil on a sharpening stone)
      a Oil on the stone produces a paste that provides a uniform sharpening surface.
      b. Oil acts as a lubricant that keeps the tool edge cool and helps to hold the tool's temper.
   2. Dry Stone
      a. Easy to carry on camping trips.
      b. Less messy to use.

B. A badly chipped edge should be filed smooth before honing.
   1. Place tool on a bench or wooden block.
   2. Push the file over cutting edge of blade - the file cuts on forward strokes.

3. When the entire blade is smooth and bright, turn the tool over and do the other side.

C. Hone the smooth blade to a sharp edge with a wet or dry sharpening stone.
   1. Knife or other small tool
      a. Lay blade edge on stone and raise the back of the blade slightly.
      b. Stroke the full length of the edge across the stone away from you in a slicing motion.
      c. Turn the blade over and stroke towards you in the same manner.
      d. Continue back and forth until the edge is sharp.
      e. Wipe the blade.
   2. Ax or other heavy tool
      a. Touch up edge with a file if needed.
      b. Hold ax in one hand with handle up and blade facing away.
      c. Rub stone from top to bottom of blade in a pushing motion away from the blade.
      d. Turn handle down exposing the other side of the blade. Using the same hand, repeat the pushing motion of stone along entire length of the blade.

Observation Hike: Communications

1. Discuss ways that people have developed to communicate with each other.

2. Discuss ways that other animals use to communicate.

3. Study historical events where communications or the lack of it, played an important part. Some examples follow:
   a. Pheidippides' famous run that brought the news of the Athenian victory over the Persians at Marathon in 490 B.C.
   b. The ride of William Dawes and Paul Revere, at the start of our country's Revolutionary War.
   c. The Battle of New Orleans occuring after the War of 1812 was technically over.
   d. General Lee's hesitation at Gettysburg due to a lack of communication and information among his southern forces.

4. Invite someone to visit your classes who is fluent in another language. Learn a song in that language.

5. Invite someone to visit your classes who knows the sign language used by the deaf.

6. Vocabulary:

Communicate	Photography
Photograph	Photographer

O.E.E.C. Activity

As with all our hikes, this is to be a general observation hike, during which various natural phenomena may be observed and discussed. This time, however, additional emphasis is to be placed on communications and photography.

All children, especially those living and attending school in a bi-racial community need help in developing ways to communicate with each other. It is hoped that this experience will increase our students knowledge of that art.

I. Each group will carry the following materials:
   A. A pad and pencils
   B. A drum and beater
   C. A signal mirror
   D. A two-way radio
   E. Cameras and film
   F. An instructor's whistle

II. Before setting out on their hike the instructors will show the students how to operate their cameras. Picture taking may take place throughout the activity.

III. Following two different courses the groups will stop at stations, represented by the letters below, where they will communicate with each other.
   A. As the groups proceed north along the trails on either side of Spring Creek, they can experiment with various types of vocal communications like yells, shouts and whistles. They can also try imitations of bird and other animal calls as the American Indians might have done.
   B. Next the groups will stop where they are out of sight, but still within hearing distance, and where there is a connecting path between them. One group will devise a drum beat code. A duplicate will be sent by foot messenger to the other group. They will then send drum messages back and forth.
   C. Students and instructors will then move to a spot where they are too far away to hear the other group, but from which they can see each other. Here they will practice using signal mirrors, if the sun is out.
   D. At this station the groups will be beyond sight and sound of each other. From here they may communicate via the two-way radios.
   E. The instructors may also wish to explain the standard distress signals.
      1. The call for help is three of any signal at frequent intervals. The "O.K." or "all clear" sign is two signals together. Instructors may demonstrate these signals with their whistles.
      2. Other signals, like three fires or three blankets in a row in a field can also be used to signal for help.
      3. The S.O.S. signal in Morse Code is three dots, three dashes and three dots. The instructors may wish to demonstrate this signal also.

IV. The two groups may then exchange positions and take the other path back to the main campus of the O.E.E.C., using up the remaining photographs and listening for signs of animals communicating along the way.

Classroom Follow-up

1. Have your students contribute to a bulletin board depicting the history of communications.

2. Bell Telephone Company will present a communications demonstration in classrooms when prior arrangements are made through their Commercial Department. For more information call 238-0526.

3. Research the history of photography.

4. Study light and how a camera works.

5. Invite a professional photographer in to explain his occupation, and demonstrate some of his equipment.

6. When you receive the pictures that your students took, have each class vote for the best class photograph.
Lightly pencil on the back of the photo, the students name, school, room number, and teachers name.
Send the winning photo from each class, to the OEEC by interdepartmental mail.
OEEC staff members will select the best of the winners for publication in our newsletter "OEECology News."

7. Films from the Harrisburg City Schools film library that relate to this lesson are:

"Communications- A First Film"
"Animals And How They Communicate"
"Evan's Corner"
"Color And Light- An Introduction"
"Light For Beginners.